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THE NEW CLASS "J" PASSENGER LOCOMOTIVE of the LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

Designed by W. H. Marshall, Superintendent of Motive Power.

Built by the Brooks Locomotive Works.

(With an Inset.)

We are privileged in this issue to illustrate the new passenger locomotives just completed by the Brooks Locomotive Works for the Lake Shore & Michigan Southern Railway. They were designed by Mr. W. H. Marshall, Superintendent of Motive Power of the road, and represent his views as to what is needed to meet the demands of heavy and fast passenger service. The chief aim was to secure ample power, with a reserve for emergencies, in an engine carefully designed to avoid breakdowns.

The design is bold, not in the use of uncertain factors, but in the assembling of such features as 3,343 sq. ft. of heating surface, 48½ sq. ft. of grate area, 19-ft. tubes, 20½ by 28-in. cylinders, with six coupled driving wheels 80 ins. in diameter, a pony leading truck, radial trailers and piston valves. These are skilfully combined in the handsome locomotive illustrated in the inset accompanying this issue. It gives no suggestion of the unusual factors employed—these are concealed in the symmetrical arrangement. The desire to secure a symmetrical and attractive result led to the preparation of a perspective drawing of the engine before the work was started, in order to permit of choosing harmonious proportions whenever a choice was possible. A modern passenger locomotive is thoroughly worthy of such efforts.

In the matter of large boiler capacity this engine and that of the New York Central, illustrated last month, are nearly alike, but the Lake Shore engine stands for six coupled wheels and great tractive weight available all the time and the other for four coupled wheels with additional tractive weight applied only in starting.

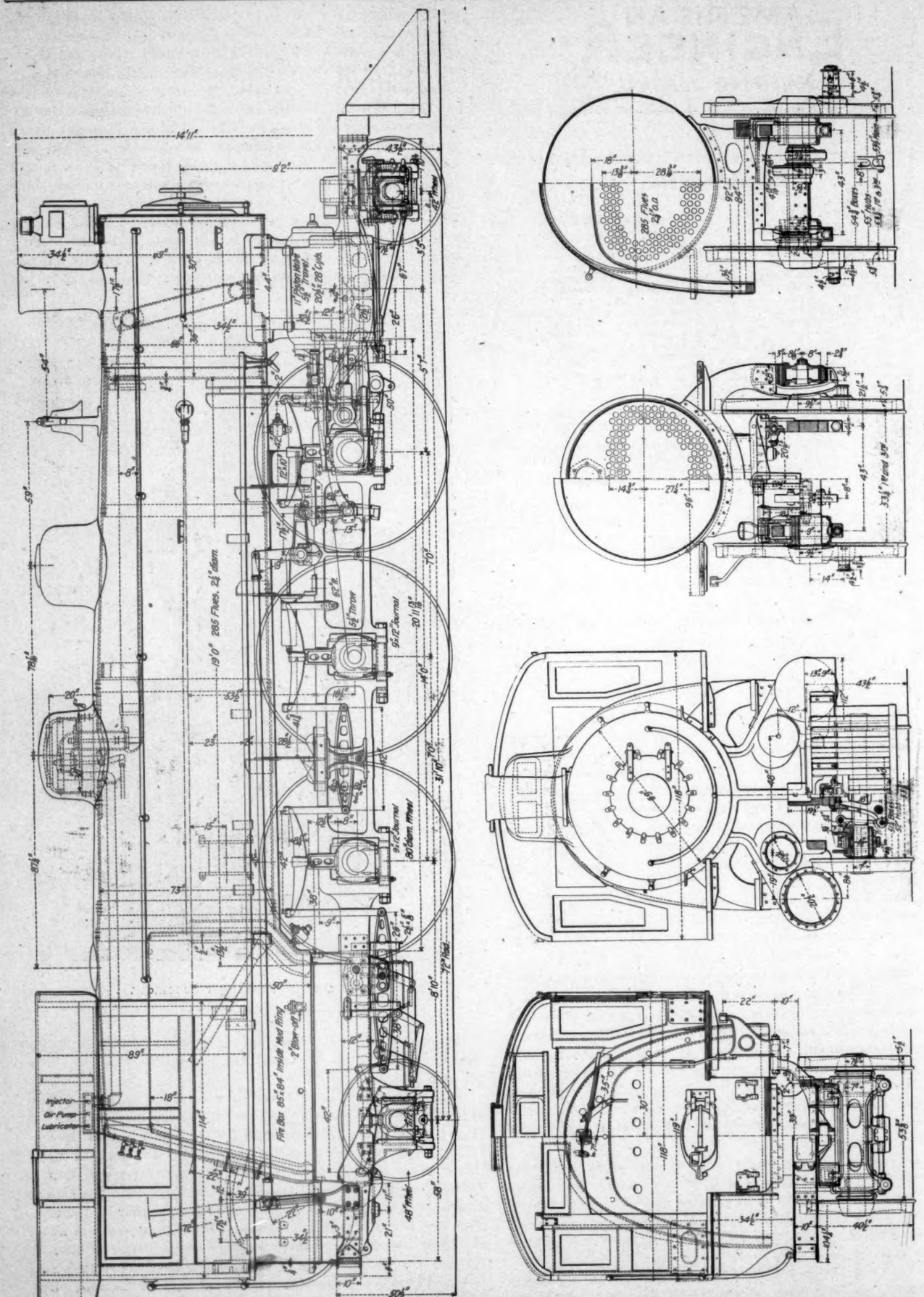
The basis for the new Lake Shore design was the 10-wheel, type which has been very successful on this road (American Engineer, November, 1899, page 344), for over a year. These 10-wheel engines have averaged more than 100,000 miles of service during their first year. It was necessary to build more engines, and this offered an opportunity to considerably increase the facilities for dealing with heavy trains and secure additional reserve capacity for cold and stormy weather, accidental delays and slippery rails. The total weight was limited, and this made the problem the more difficult, necessitating extensive use of cast steel and the design of many special details for the elimination of unnecessary weight. This weight saving was very skilfully done, and the result is 52.18 lbs. of total weight per square foot of heating surface, a remarkably low figure, as the table elsewhere in this issue indicates.

The boiler is long, with a conical wagon top and sloping throat sheet and back head. It was made to fit the driving wheels, for which there was no spare room. There is but one fire door opening, but that has two doors, one opening in the

New Class "J" Passenger Locomotive.
L. S. & M. S. Railway.

other, the small one being used for firing and both being opened for cleaning fires and for access for repairs. The smaller door is 19 by 11 ins.

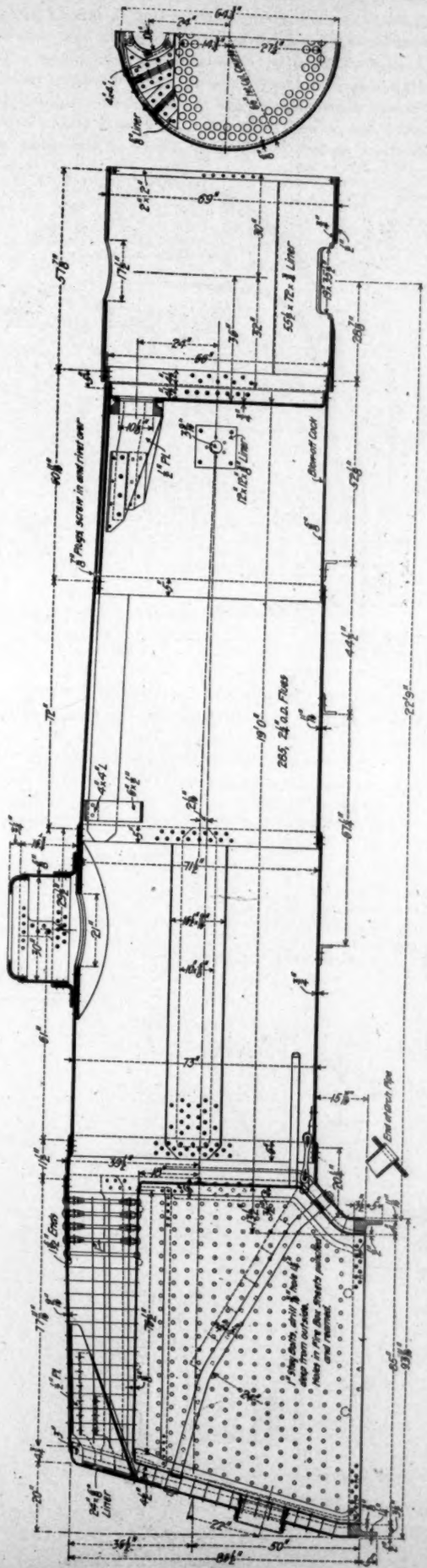
No special or unusual precautions were taken in the use of 19-ft. tubes; they were made of No. 11 gauge, and 2¼ ins. in diameter for the sake of stiffness. With piston valves the single deep bar front frame section brings the stresses in a direct line with the driving boxes. The front frame brace and spindle guide is of cast steel, well ribbed. At the back ends the frames again take the slab form and are well tied together by the cast-steel foot plate, in which the plate, ribs and flanges are of about the same thickness, large bunches of metal being avoided to prevent cracked castings. The cab brackets are thin plates held between two channels at the rear face of the foot plate. The boiler is supported at the firebox by two plates secured to 5-in. lugs 38 ins. long welded on the front and back of the mud ring. The one at the back head is bolted to the front face of

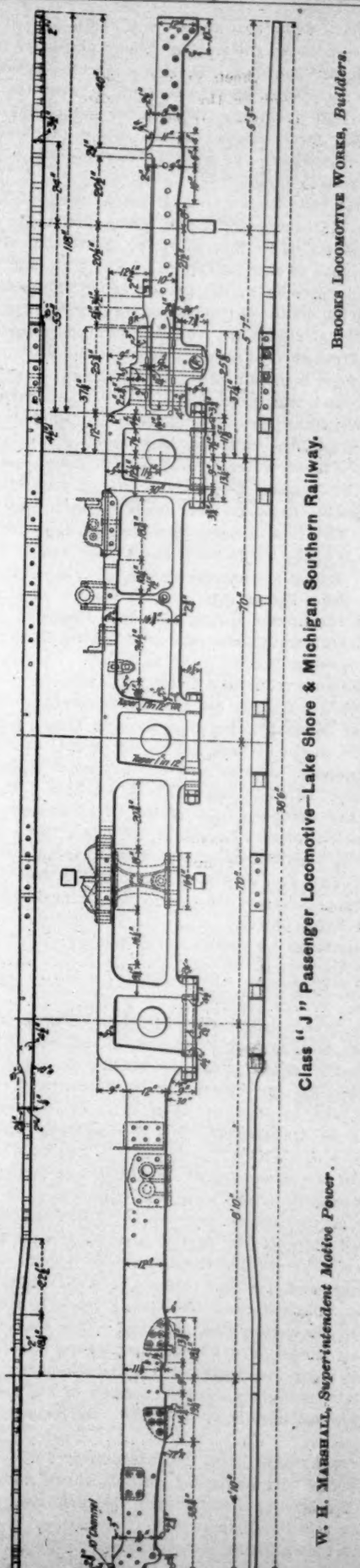


Class "J" Passenger Locomotive—Lake Shore & Michigan Southern Railway.

BROOKS LOCOMOTIVE WORKS, *Builders.*

W. H. MARSHALL, *Superintendent Motive Power.*





Class "J" Passenger Locomotive—Lake Shore & Michigan Southern Railway.

BROOKS LOCOMOTIVE WORKS, *Builders.*

W. H. MARSHALL, *Superintendent Motive Power.*

the foot plate, while that at the front end is carried by a cross-bar secured between the frames. These plates are free to bend to provide for expansion. There are no other furnace bearers. There are three waist sheets extending between the frames and boiler, so that, including the cylinder saddle, these parts are tied together in six places. It will be seen that these supports brace the frames at every point where the spring rigging transmits stresses to them.

The guide yoke has an unusual shape, as shown in the detail drawings. It curves under the boiler and drops outside the driving wheels in another curve, at the bottom of which is a cast-steel yoke to carry the guides. These are flat, with a long overhang, best seen in the photograph. This was a particularly difficult detail which was admirably worked out.

The driving wheels are from the same patterns as used for the large ten-wheeled engines already referred to, but slight changes were made to effect a saving in weight; these and the truck and trailer wheels all have thin spokes and look particularly light and neat. Brakes are applied only to the driving wheels, the cylinders being back of the forward axle with the cylinder levers fulcrumed in bosses on the lower faces of the frames. Everywhere weight was minimized and where possible castings were made to serve more than one purpose. The link hanger bearings, brackets for the boiler brace, back of the guide yoke, and spring hanger bearings for the front driving springs are combined in a single steel casting. The grate bearers are of pressed steel, making a packed joint with the firebox sheets and supporting also the ash pan.

Rather short main rods were necessitated by the position of the main wheels, but the ratio is 1 to 7. Piston valves with inside admission required a direct valve motion. This employs a cross head and guide bar instead of return rocker arms, a motion bar being used between the link blocks and the valve stem. The angle of this bar is not great, and the motion is very compact. It was used on the recent 10-wheel piston-valve engines of this road. The valves have L-shaped packing rings and extended valve stems. With a view of reducing the obstruction of the passage of the steam the bridges in the ports of the bushings are made narrow, as shown in the engravings. This and 5⅜-in. nozzles ought to help in the matter of back pressure which is becoming manifestly important with high horse power.

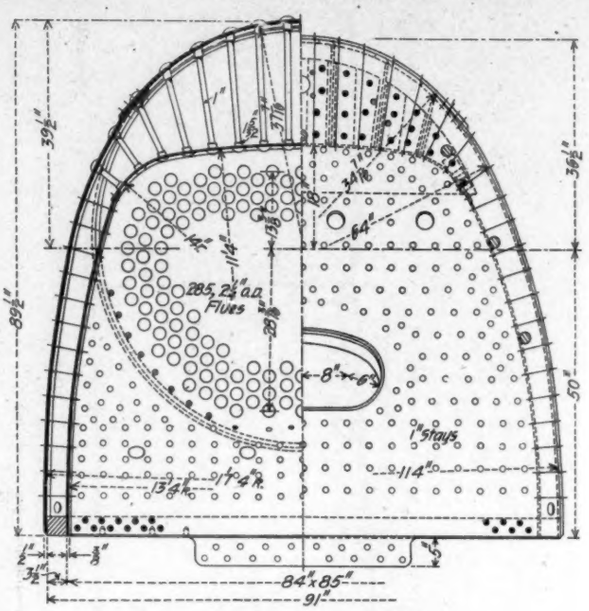
The weights of the engine are as follows:

Weight on front truck	21,500 lbs.
Weight on drivers	130,000 lbs.
Weight on trailing wheels	23,000 lbs.
Weight, total	174,500 lbs.

It is, therefore, lighter than the New York Central engines, and yet the total heating surface is but 162 sq. ft. less. In order to permit of changing the distribution of weight three holes are provided for the fulcrum pins of the truck and trailer equalizers, and by changing them more or less weight as desired may be transferred from the carrying wheels to the drivers.

A part of the symmetry of outline is due to the large cab. It is surprisingly roomy, being 9 ft. 6 ins. long and 9 ft. 11 ins. wide over all, the firebox projects but 2 ft. from its front end. The curved sides of the firebox also contribute to the good appearance. The driving wheels have but 1½-in. clearance between flanges and the front pair are very close to the cylinders. There was sufficient room for a pony truck in front, but not at the rear because of the ash pan. This required a radial truck as an inside journal truck was desired. The whole back end of the engine is clear and free from a heavy appearance. This radial truck gives a lateral motion of 3¼ ins. each side. The total wheel base is 31 ft. 10 ins., the longest we have on record.

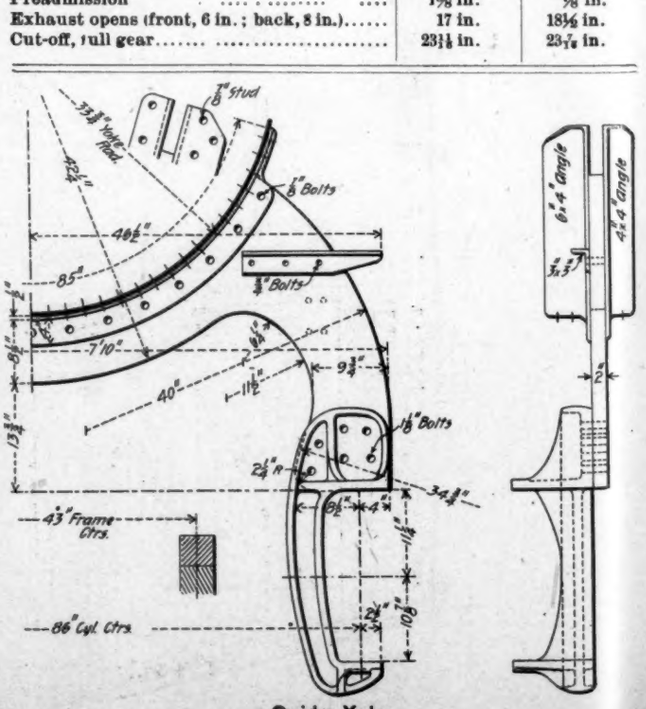
Radial trucks have been used extensively abroad, they seem to offer special advantages for trailing wheels under fireboxes. A patent has been applied for upon the form used in this case, and in the recent "Chautauqua" type engines by the Brooks works, and shown in the accompanying engraving. The frame of this truck is cast steel and the boxes are malleable iron. The boxes have spring cellars and a strong spring centering device. The wear from the load upon the ends of the radial casting is taken by case-hardened iron plates. This truck is simple and compact. We desire to draw the attention of our readers especially to this feature of the engine. It appears to curve easily and to promise very satisfactory service for this location, under the firebox. There is also good reason to believe it equally promising for the front ends of engines to replace pony trucks.



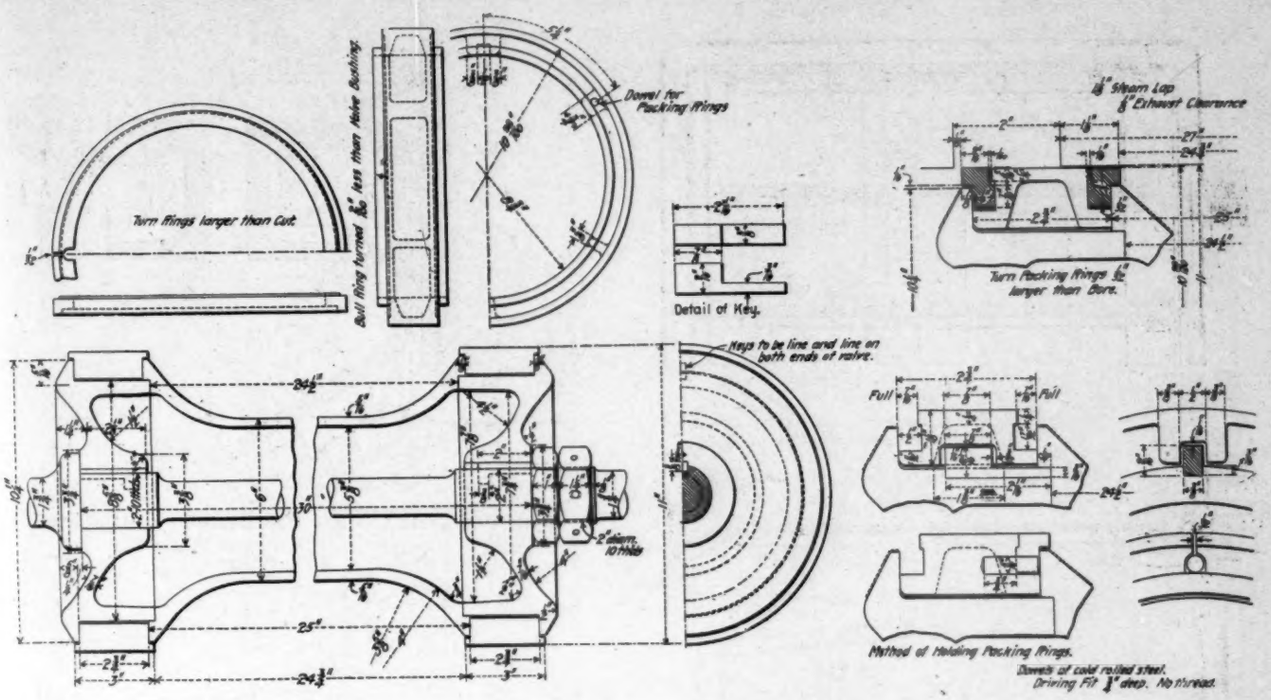
Section and Elevation of Firebox.

The following table gives some particulars regarding the valve setting. The saddle pins are offset 23/32 in. back and the link radius is 62 ins.

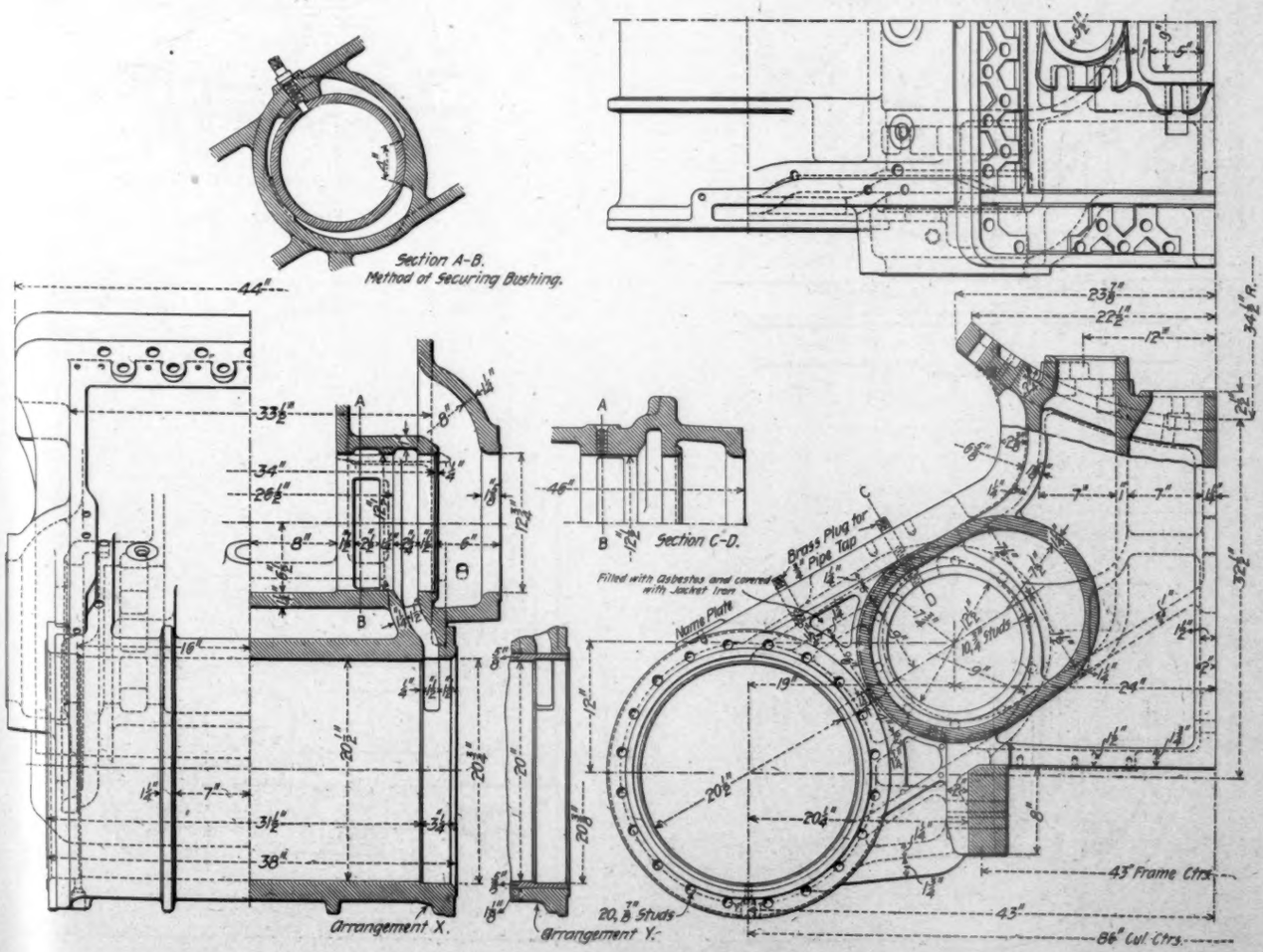
	Front.	Back.
Lead in full gear	0 in.	1/32 in.
Lead (front, 6 in.; back, 8 in.)	5/32 in.	7/32 in.
Port opening (front, 6 in.; back, 8 in.)	1 1/32 in.	3/16 in.
Preadmission	1 3/16 in.	7/16 in.
Exhaust opens (front, 6 in.; back, 8 in.)	17 in.	18 1/16 in.
Cut-off, full gear	23 1/16 in.	23 7/16 in.



Guide Yoke.
Independent of Frames.

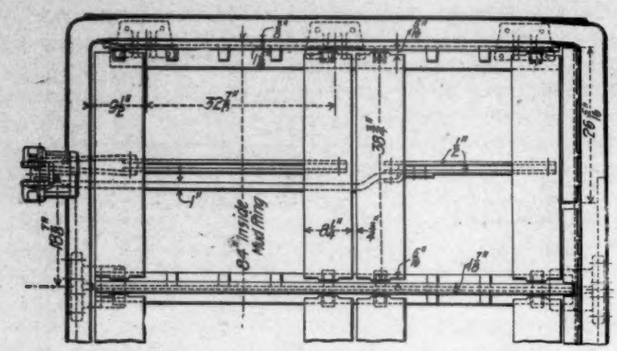

Turn Rings larger than Cut.
Bull Ring turned ⅛" less than Valve Bushing.
Dowel for Packing Rings
Detail of Key.
Steam Lap
Exhaust Clearance
Turn Packing Rings ⅛" larger than Bore.
Keys to be fine and line on both ends of valve.
Pull
Pull
Method of Holding Packing Rings.
Dowels of cold rolled steel. Driving Fit ½" deep. No thread.

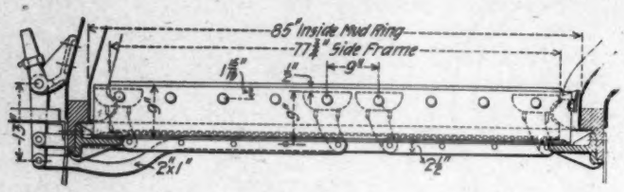
Piston Valve and Packing Rings.

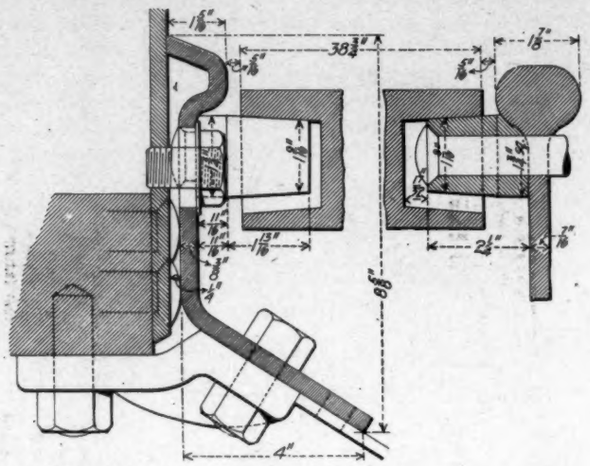


Cylinders and Steam Chests.

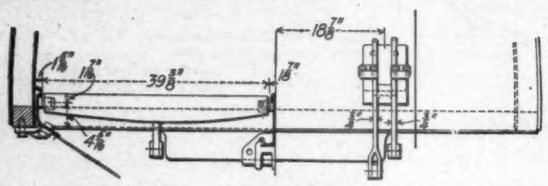
Class " J " Passenger Locomotive—Lake Shore & Michigan Southern Railway.



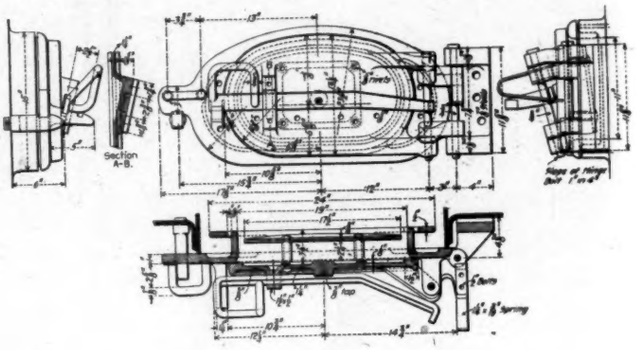




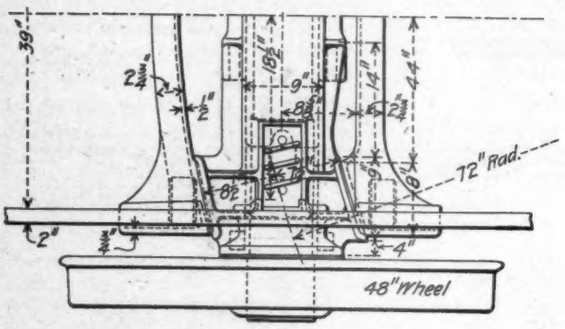
Details of Grate and Ash Pan Bearers—Pressed Steel.

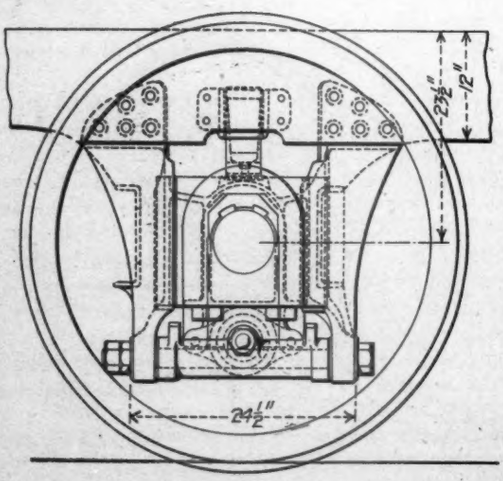


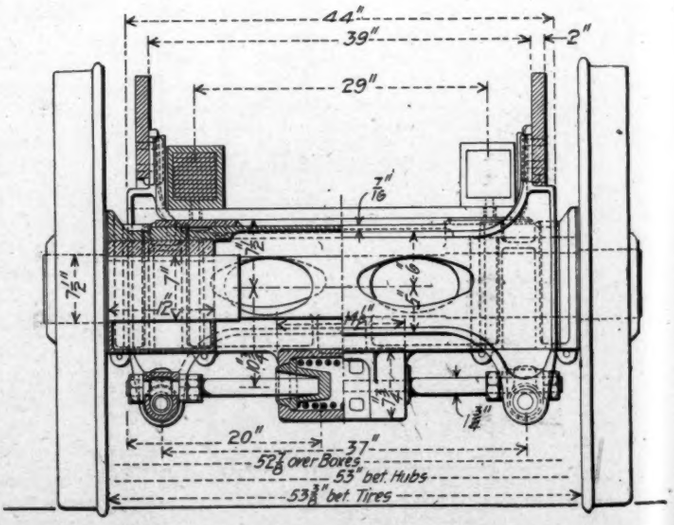
Arrangement of Grates.



Fire Door.

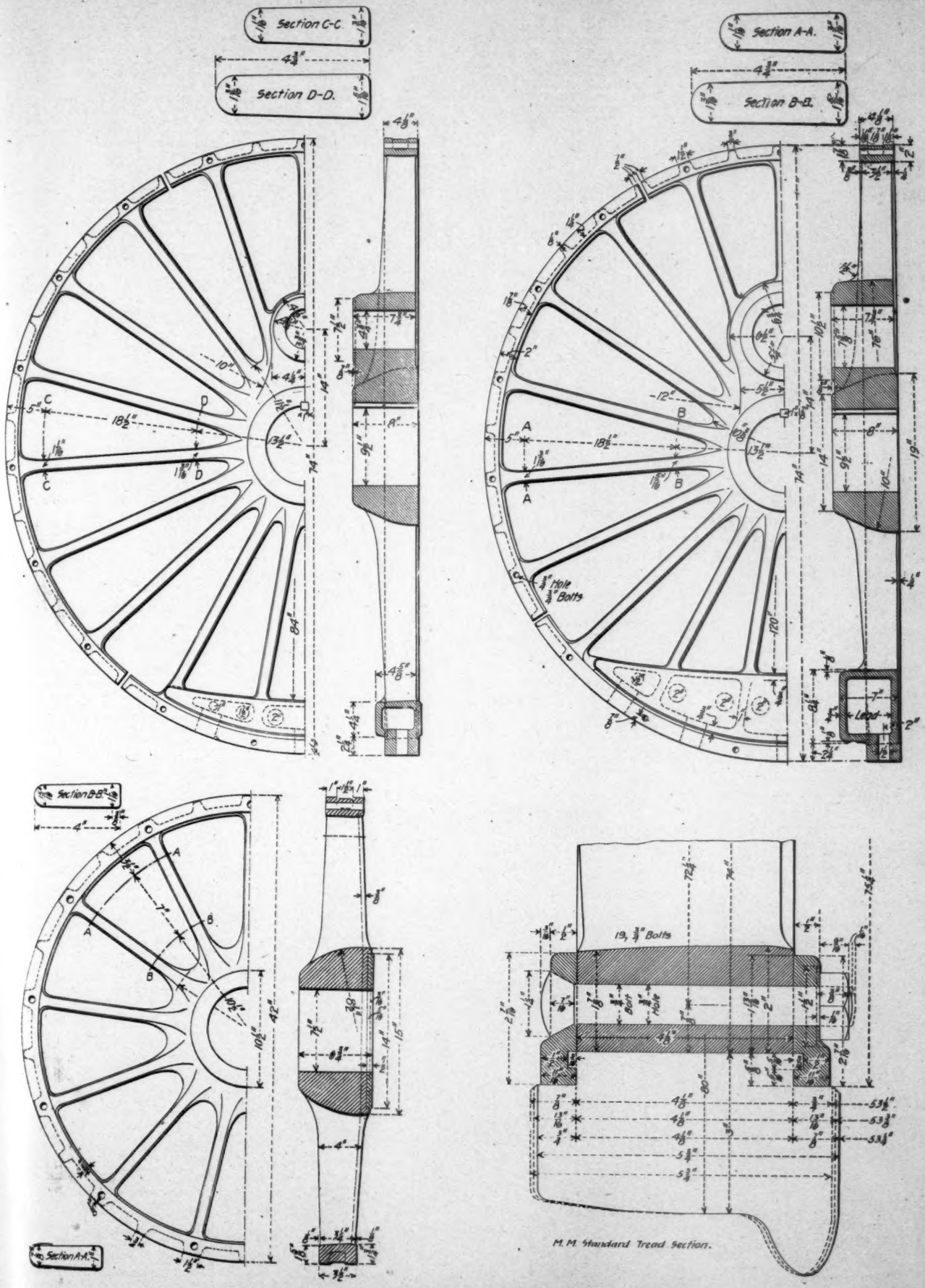






Radial Trailer Truck.

Class "J" Passenger Locomotive—Lake Shore & Michigan Southern Railway.



Cast Steel Driving and Truck Wheels.

Class "J" Passenger Locomotive—Lake Shore & Michigan Southern Railway.

Measurements of Valve Motion.

Admission	Internal
Valve travel	5½ ins.
Eccentric throw	5½ ins.
Lap	1⅛ ins.
Exhaust clearance	⅛ in.
Link radius	62 ins.
Link center	62¾ ins.
Lift of link	13 ins.
Slip of link	1½ ins.
Saddle offset	23/32 in.

Position.		Pre-admission.		Lead.		Port opening.		Cut-off.		Release		Closure.	
		F.	B.	F.	B.	F.	B	F.	B.	F.	B.	F.	B.
Forw'd motion.	Full gear...	0	0	0	0	1¾	1¾	23¾	23⅝	26⅝	26⅝	1	1
	5-in. notch.	1⅝	1⅝	3/32	3/32	11/16	11/16	6	6 1/16	16⅞	17	8⅝	8½
		Pos.											
Back motion.	Full gear...	0	0	1/32	1/32	1⅝	1 11/16	23⅛	23¾	26¾	26	1¼	1¼
	8-in. notch.	7/8	7/8	5/32	5/32	5/8	5/8	8	8	18⅜	18½	7⅛	7⅝

As worthy of special mention we would call attention to the unusually large number of details made of cast steel even for these days when this material is extensively used. Even the equalizers are made of cast steel and altogether about 28,000 lbs. of this material is used in the engine. In fact, there is very little cast iron exclusive of the cylinders and grates. We would also call attention to the enlarged wheel fits for all axles and crank pins, and the care with which the frames have been braced to the boiler at all points where it receives direct vertical stresses. Many of the details, such as truck and driving boxes, shoes, wedges, pedestals, cross heads, eccentrics, eccentric straps, valves, cylinders, etc., are the same as in the 10-wheel passenger engines. The ashpan is provided with drop bottoms and has no dampers, the air openings being covered with netting. The front end is self-cleaning and has no spark hopper. The diapnragm is placed in front of the nozzles. The firebox is lagged all over. Plate gusset bracing is used for the back head and front tube sheet of the boiler. The springs are made up of very wide plates; those for the driving springs being 6 ins. and those for the trailing springs being 5 ins. in width. The tires are set as follows:

Wheels.	Distance between flanges.
First and third	53¼ ins.
Main wheels	53½ ins.
Trailers	53⅜ ins.
Truck	53⅜ ins.

These engines will be expected to haul trains weighing from 350 to 650 tons between Buffalo and Cleveland on schedules varying from 4 hours and 15 minutes to 4 hours and 30 minutes and making four stops in a distance of 183 miles. It might be stated in explanation that none of the trains are scheduled to consist of more than 10 cars regularly, but they are frequently given additional cars so that 12 or 13 cars are not unusual in winter, and in summer trains scheduled to make the division in 4½ hours have contained 15 cars and weighed 640 tons. A slow train having a schedule of 6 hours and 15 minutes, and making 22 stops, has several times had 16 cars and once was composed of 18 cars. Of course, these exceptionally large trains are unusual, but in designing these engines the idea has been to provide ample power for every-day conditions and also to be able to take such occasional trains without dividing them into two sections. One of the 10-wheel engines, already referred to, has made up in January weather 35 minutes on the 40-mile schedule of 183 miles with a train of 550 tons. It is evident that the large amount of tractive weight is important under these conditions.

The tenders are made to bring down the coal to the fireman, the slopes being carried to the front where they narrow to the coal gate. They are carried on the Brooks design of tender truck of the arch-bar type, which are noteworthy for strength. The tenders are fitted with the water scoop designed by Mr. H. F. Ball, Mechanical Engineer of the road. The details of construction were presented in our November number, 1900, page 344. This is operated by compressed air.

Two of these engines have been completed, to be followed by 11 more from the same drawings. The principal dimensions are summed up in the following table:

CLASS "J" PASSENGER LOCOMOTIVE.
Lake Shore & Michigan Southern Ry.

Description.	
Gauge	4 ft. 8½ ins.
Kind of fuel to be used	Bituminous coal
Weight on drivers	130,000 lbs.
Weight on truck	21,500 lbs.
Weight on trailing wheels	23,000 lbs.
Weight, total	174,500 lbs.
Weight of tender, loaded	118,000 lbs.
Wheel base, total of engine	31 ft. 10 ins.
Wheel base, driving	14 ft. 0 in.
Wheel base, total, engine and tender	57 ft. 3¼ ins.
Length over all, engine	43 ft. 5 ins.
Length over all, total engine and tender	68 ft. 10⅜ ins.
Height, center of boiler above rail	9 ft. 2 ins.
Height of stack above rails	14 ft. 11 ins.
Heating surface, firebox	174 sq. ft.
Heating surface, tubes	3,169 sq. ft.
Heating surface, total	3,343 sq. ft.
Grate area	48.5 sq. ft.
Wheels, leading, diameter	42 ins.
Wheels, driving, diameter	80 ins.
Wheels, trailing, diameter	48 ins.
Material of wheel centers	All cast steel
Type of leading wheels	Two-wheel bogie
Type of trailing wheels	Radial axle
Journals, leading axle	6½ ins. by 12 ins.
Wheel fit, leading axle	7 ins.
Journals, driving axle	9 ins. by 12 ins.
Wheel fit, driving axle	9½ ins.
Journals, trailing axle	7 ins. by 12 ins.
Wheel fit, trailing axle	7½ ins.
Cylinder, diameter	20½ ins.
Cylinder stroke	28 ins.
Piston rod, diameter	3⅝ ins.
Main rod length, center to center	99 ins.
Steam ports, length	26½ ins.
Steam ports, width	2 ins.
Exhaust ports, least area	75 sq. ins.
Bridge, width	3 ins.
Valves, kind of	Piston
Valves, greatest travel	5½ ins.
Valves, steam lap (inside)	1⅛ ins.
Valves, exhaust clearance (outside)	⅛ in.
Lead in full gear	Line and line in forward gear
Boiler, type of	Extended wagon top
Boiler, working steam pressure	200 lbs.
Boiler, material in barrel	Steel
Boiler, thickness of material in shell	⅝ in., 11/16 in., ¾ in., 9/16 in., ½ in.
Boiler, thickness of tube sheet	¾ in.
Boiler, diameter of barrel, front	66 ins.
Boiler, diameter of barrel at throat	73 ins.
Seams, kind of horizontal	Sextuple
Seams, kind of circumferential	Double and triple
Crown sheet, stayed with	Radial stays
Dome, diameter inside	30 ins.
Firebox, length	85 ins.
Firebox, width	84 ins.
Firebox, depth, front	68 ins.
Firebox, depth, back	68 ins.
Firebox, material	Steel
Firebox, thickness of sheets	Crown, ⅜ in.; tube, ½ in., side and back, ⅜ in.
Firebox, brick arch	On water tubes
Firebox, mud ring, width	Back and side, 3½ ins.; front, 4 ins.
Firebox, water space at top	Back, 4½ ins.; sides, 5 ins.
Grates, kind of	Cast iron, rocking
Tubes, number of	285
Tubes, material	Charcoal iron
Tubes, outside diameter	2¼ ins.
Tubes, thickness	No. 11 B. W. G.
Tubes, length over tube sheets	19 ft. 0 in.
Smokebox, diameter outside	69 ins.
Smokebox, length from tube sheets	66 ins.
Exhaust nozzle, single or double	Single
Exhaust nozzle, variable or permanent	Permanent
Exhaust nozzle, diameter	5⅜ ins.
Exhaust nozzle, distance of tip below center of boiler	4 ins.
Netting, wire or plate	Wire
Netting, size of mesh or perforations	2½ by 2½ per inch
Stack, straight or taper	Cast iron taper
Stack, least diameter	15 ins.
Stack, greatest diameter	16⅞ ins.
Stack, height above smokebox	34½ ins.
Tender.	
Type	8-wheel steel frame
Tank, type	U-shape
Tank, capacity for water	6,000 gals.
Tank, capacity for coal	11 tons
Tank, material	Steel
Tank, thickness of sheets	¼ in.
Type of under frame	Steel channel
Type of springs	Triple elliptic
Diameter of wheels	36 ins.
Diameter and length of journals	5½ ins. by 10 ins.
Distance between centers of journals	5 ft. 6 ins.
Diameter of wheel fit on axle	6⅞ ins.
Diameter of center of axle	5⅞ ins.
Length of tender over bumper beams	21 ft. 10½ ins.
Length of tank inside	20 ft. 4 ins.
Width of tank inside	9 ft. 10 ins.
Height of tank, not including collar	60 ins.
Type of draw gear	M. C. B. coupler
Special Equipment.	
Brakes	American for drivers; Westinghouse for tender and train service
Pump	9½ ins.
Sight feed lubricator	Nathan
Safety valves	Ashton
Injectors	Hancock
Springs	French
Metallic packing valve stems	Brooks Locomotive Works

An indication of the strong hold of the wide firebox upon the design of locomotives for soft coal was noticed recently in a visit to the Schenectady Locomotive Works. Fourteen out of seventeen tracks in the erecting shop were occupied by locomotives with wide fireboxes, the wide firebox engines were for four different orders, and entirely different designs.

Pulverized coal appears to have some exceedingly favorable characteristics for use as boiler fuel and prevailing high prices of oil have occasioned a number of experiments in its use in small forge shop furnaces. We have also seen rather remarkable reports of tests with it in the firebox of a locomotive. It is necessary to grind the coal to an exceedingly fine state, and as it is unsafe to store it at all the grinding must be done at the furnace as the fuel is required. The coal need not be dry. When the conditions are as they should be the combustion seems to be perfect and the heat intense. The most successful and extensive use of this fuel is in the manufacture of cement.

That exceedingly economical power production may be had with steam is well known, but that the economy of the gas engine is nearly approached by the Allis pumping engine at the Chestnut Hill pumping station of the city of Boston is brought out by "Engineering News." This engine is a triple-expansion, running at 17.2 revolutions per minute, the coal consumption being 1.062 lbs. per indicated horse-power per hour. This is believed to be the lowest coal consumption ever attained by a stationary steam plant.

The trouble which has developed from the new round bottomed M. C. B. standard journal boxes illustrates the necessity for special care in the adoption of standards in order to guard against the inconvenience of changes. It appears that in some quarters the waste used as packing for the boxes with semi-circular bottoms has been moved bodily by the journals to the extent of cutting off the lubrication. A few projections from the casting seem to remedy the difficulty, but it seems unfortunate that this should have escaped attention in the original design.

Mr. Godfrey W. Rhodes, Assistant General Superintendent of the B. & M. R. R. R., delivered on Thursday, January 24th, an address before the engineering students of Purdue University. His subject was "The Burlington Brake Tests." He first described the various changes which step by step have led from the hand brake to the present high-speed brake, and briefly discussed their significance. After referring to the extent and character of the Burlington tests, he emphasized the fact that every brake which on that occasion was subjected to test had been pronounced unsatisfactory by the committee, and that all have since disappeared from service. It was worthy of note that no one had complained or had found fault with the committee because of its conclusions. Those whose apparatus had given most promise found in the results facts which served to give new ideals and to lift their practice to higher planes. The Burlington tests proved the impracticability of the buffer brakes and disclosed serious defects in the automatic air brake which at that time was in its early stages of development. The work, he said, had profited by the association of a large number of persons who were concerned in planning its details and in the final execution of the tests, the credit for the results being shared by from thirty to fifty people. The modesty with which the speaker referred to the difficulties encountered, and to the far-reaching effect of the results obtained, aroused but slight suspicion in the minds of the student audience that he was the leader in the great work he described.

Electric street cars have been known to become stalled for lack of current when upon the crossings of steam roads with a frequency which has excited curiosity as to the cause and not a little alarm as to the possible consequences. A reasonable explanation is offered by Mr. A. A. Knudson in a report upon electrolysis in Reading, Pa., which is printed in the "Engineering Record." Mr. Knudson found one particular crossing in that city to be deficient, if not altogether lacking, in the bonding of the rails. If the bonding is deficient the ground must be depended on for the return, and if that is dry the car may become stalled on what is practically an open circuit. It is evidently of the utmost importance that the rails and crossing frogs should be particularly well bonded in such cases.

A method of testing the springs of indicators by direct weighing is recorded by Mr. G. Duchesne in the "Revue de Mecanique." Mr. Duchesne was formerly associated with Professor Dwelshauvers-Dery. He recommends exposing the indicator to the heat action of the steam long enough to heat it thoroughly. The instrument is then secured by a clamp in an inverted position, so that a rod could be rested upon the piston. Weights were added in equal increments to the rod and the effect upon the spring taken on the paper. The action in increasing and decreasing the load was measured and the recovery of the spring ascertained. This appears to be a very satisfactory and an easy way to test indicator springs. It also has the advantage of eliminating errors which may be introduced by the pencil mechanism.

The most extensive superheating plant in the world has been completed by the Aachen Mining Company, at their Rothe Erde Works. Forty-two Schwoerer's super-heaters have been installed in the flues connected with a similar number of Cornish double-flued boilers having aggregate heating surface of 47,363 sq. ft. Super-heaters of the same type are also applied to a second group of twenty-four Cornish boilers, with a heating surface of 26,910 sq. ft. Very careful tests, extending over three years of day and night working, have shown the saving in fuel by the use of this plant to be from 15 to 20 per cent., coal being delivered at the works for less than $2.20 per ton. An interesting fact in connection with the plant is that in a distance of 1,050 ft. traversed by the steam through a 24-in. pipe, a loss of only 1° C. for each 42 ft. of pipe was found.

An account is given in the "Bulletin de la Societe d'Encouragement pour l'Industrie Nationale," of an apparatus, the invention of the author and Mr. Vinsonneau, for the examination of boiler tubes. By reference to diagrams the construction and use of the apparatus is explained. It consists of a tube fixed at right angles in a chamber provided with a magnifying eye-piece. At the further end of the inspection tube, which is capable of being drawn out to suit the length of the boiler tube under examination, is an incandescent electric lamp, and an angular plane reflector which transmits the rays to a reflector inclined at a similar angle under the eye-piece. The tube in process of inspection is fixed in a traveling carrier, which permits every part of it to be examined in turn. The carrier is provided for this purpose with both a horizontal and a rotary movement. The present apparatus is designed for tubes of 6.56 ft. in length by 1½ in. in diameter, but the same principle can be applied to tubes of larger size and greater length. An apparatus for use in the case of tubes in situ has also been devised, and, by reference to a diagram, a method of employing the apparatus for the examination of the exterior surfaces of tubes is explained. It is stated that this invention has proved very satisfactory in use, and that it has often revealed defects in the interior of tubes which externally presented every appearance of soundness.—[Inst. C. E. Abstracts.]

NEW CAR SHOPS.

New York, New Haven & Hartford Railroad,

At Readville, Mass.

Details of the Buildings.

(For General Plan see American Engineer, February, 1901, page 41.)

This large shop plant, of which the buildings alone cover 8½ acres of ground, and where 1,000 men will be employed, was described last month by aid of a ground plan. The accompanying engravings illustrate the chief details of the buildings, except the power house; this department and the machinery will be reserved for another article. Most of the principal buildings are shown in section and plan, in order to clearly indicate the methods of construction and avoid the necessity of an extended description.

Roofs.

Yellow pine is used throughout for the roof trusses. This is done because of the saving of expense, which, with so many large roofs, amounts to a large sum. The columns are also of yellow pine, except those supporting the second-story floor at the ends of the paint and erecting shops and in the mill, which are cast iron. The roof boards are white pine of varying thicknesses as shown on the plans. The two-story portions of the paint and erecting shops and the storehouse have slate roofs, all the other roofs are covered with Eastern Granite Roofing. For the slate roofs the gutters are of white pine covered with copper, the other gutters being formed in the roofing material. All the leaders are of 4-in. galvanized iron connecting with cast-iron stand-pipes 6 ft. high from the ground. The skylights are glazed with ¼-in. rough plate glass. The roofing referred to above is the Asphalt Perfected Granite Roofing of the Eastern Granite Roofing Co.

Floors.

For the paint, erecting, iron machinery, truck, piping, cabinet and freight shops, also the mill, the floors are of 12 ins. of broken stone covered with 4 ins. of hydraulic cement concrete and topped with 2 ins. of Portland cement. The concrete is 2 parts sand, 1 part cement and 4 parts of stone that will pass a 2-in. ring. The Portland cement on top is 2 parts sand to 1 part cement and 4 parts stone that will pass a ½-in. ring. The top surfaces of the floors were floated off with neat Portland cement. The storehouse floor is laid on natural earth. It has 6 ins. of concrete and 1 in. of cement, in which spruce strips are laid at 2 ft. 6 in. centers. These strips are 2 ins. wide on top by 3 ins. on the bottom and 1½ ins. thick. On these strips a 2-in. hard pine floor is nailed. In the fireproof storeroom at the end of the storehouse the floor is finished with 1 in. of Portland cement mortar instead of wood. The mill floor is of 3-in. hard pine planks laid on 6 x 6-in. timbers spaced at 24-in. centers and bedded in cinders 12 ins. deep. The cabinet shop floor is like that of the storehouse, while the power house and oil house floors are of concrete 6 ins. thick with a surface of cement 1 in. thick. In the office portion of the storehouse the floors are ⅞-in. spruce overlaid with ⅞-in. yellow pine, with one thickness of "salamander" between the floors, extending under all partitions. The floor joists are of yellow pine and are built 6 ins. into the walls and have double rows of cross bridging every 5 ft.

Painting.

All exterior exposed surfaces requiring paint have three coats of lead and oil, all tin on the roofs has a priming coat of B. P. S. "Nobrac" black paint, a second coat of "Nobrac" brown and a third coat of the same paint, black. The leaders are also painted with this brand.

Plumbing and Toilet Rooms.

This part of the work is thoroughly planned and a noteworthy feature. The wash basins are of cast iron, lined with white enamel. The plumbing is required to conform in every respect to the building laws of the city of Boston.

Wire-work lockers, 12 x 12 ins. by 5 ft. 6 ins. high, sufficient for every workman in the entire plant are a feature of the toilet rooms, which will, without doubt, be appreciated. One of the engravings illustrates the most elaborate of these toilet rooms in connection with the erecting shop and associated departments. There are 186 lockers in this group, and each man has an individual key. The plans show their distribution, also the toilet facilities in the other buildings and their somewhat novel locations.

Heating and Ventilating.

Direct steam will be used for heating the office, storehouse, freight-car shop and oil house, the other buildings requiring heat being supplied by the fan system, using exhaust steam from the power house. The paint shop will have ducts for hot air and ventilation under the floor, with openings through the floor.

The temperatures are required to be as follows: 70 degs. in zero weather in the paint shop, storehouse, offices, cabinet shop and oil house; 60 degs. in the erecting shop, storehouse, iron machine shop; other small shops, mill, freight-car shop and engine room. The dry kiln has an independent fan system.

Water Pipe and Drainage Systems.

Fire protection was considered carefully, and a system of pipes provided especially for this service. The water supply for the paint shop, wash rooms, closets and boilers is separate from the fire line, even to the connections with the city mains. A 24-ft. 55,000 gallon tank, for storage purposes, is supported at a height of 60 ft. above the shop grade and located near the oil house. An auxiliary supply will be obtained from driven wells located near Sprague street, where a pump house will be erected. The pumps will have a capacity of 200,000 gals. in 8 hours, delivered into an 8-in. main leading to the storage tank already referred to. This pump is of the triplex type driven by an electric motor. The outside hydrants located on the pipe plan are in hose houses. They have one steamer nozzle and two 2½-in. hose nozzles each. This pipe plan shows the locations of the four systems of water service and drains, the sizes of the pipes and numbers of hose connections and manholes. There are two systems of drainage, one for the closets and the other for surface and roof water. In the detail drawings we show sections of the man-holes and lamp-holes and also a section of the floor of the paint shop illustrating the slopes of the floor and the drainage openings at the center of each track and midway between the tracks.

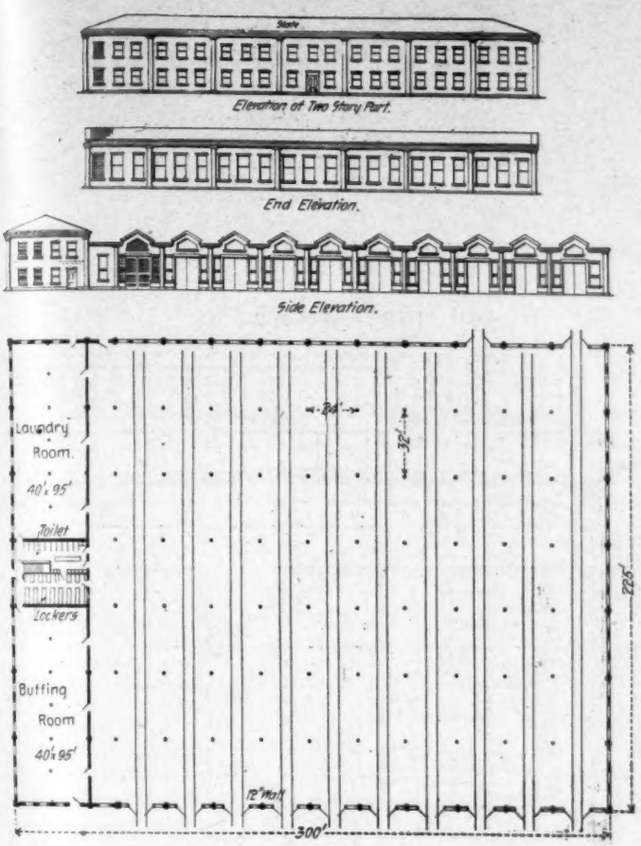
A detail section of the transfer table pit shows the drainage between the tracks. There are two rows of catch-basins across the pit, about 100 ft. from each end.

Other Details.

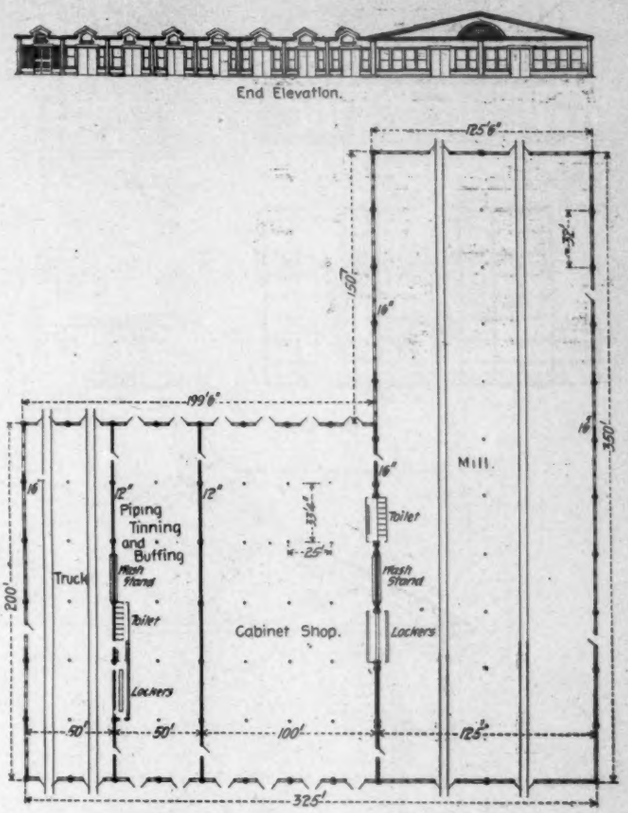
The foundations are all of rubble masonry, shown in the sectional drawings. The bottom stones were required to be not less than 3 ft. 6 in. long, and of various widths and depths. All the buildings and the chimney are faced with hard-burned brick, the same brick being used for the inside walls of the building. The thicknesses of the walls and the location of the buttresses are indicated in the plans.

The storehouse has a platform 4 ft. above the rail and a 30-ft. ramp at the office end. At the opposite end of the building is a fireproof storeroom 73 by 25 ft., with a 12-in. fireproof partition wall. This room is for the storage of combustible materials. Its door and window shutters are covered with tin laid over two thicknesses of sheet asbestos.

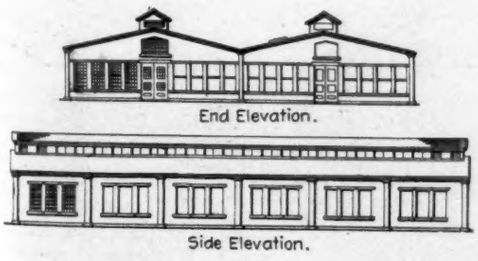
A 75-ft. transfer table will run in a pit 350 ft. long, between the two large passenger car shops. It will have a capacity of 150 tons and will be operated by a single 50-horse-power motor, giving a maximum load speed of 100 ft. per minute and a minimum load speed of 300 ft. The track stringers are 8 by 10 ins., and placed at 12-ft. centers on walls of concrete. The tim-

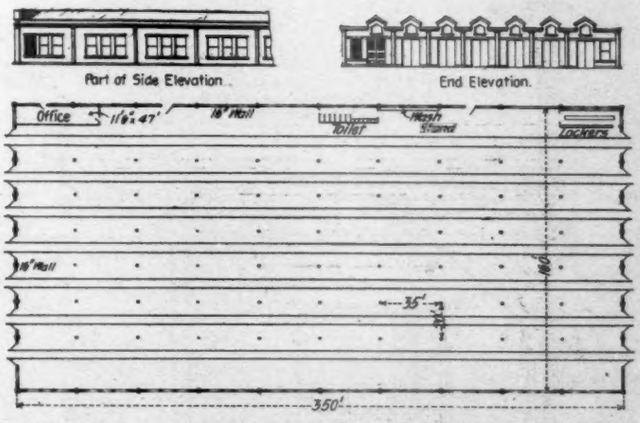


Erecting Shop.—Paint Shop Similar.

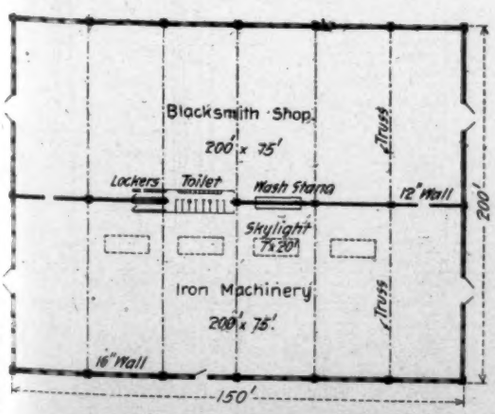


Mill, Cabinet, Pipe and Truck Shops.

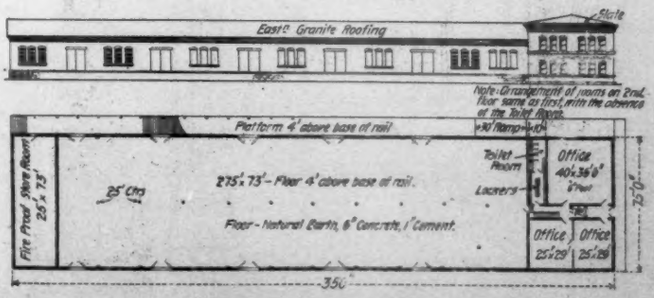




Freight Car Erecting Shop.

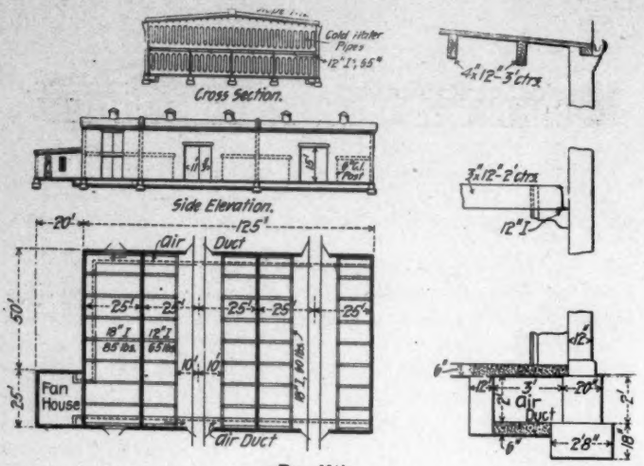


Blacksmith and Machine Shops.

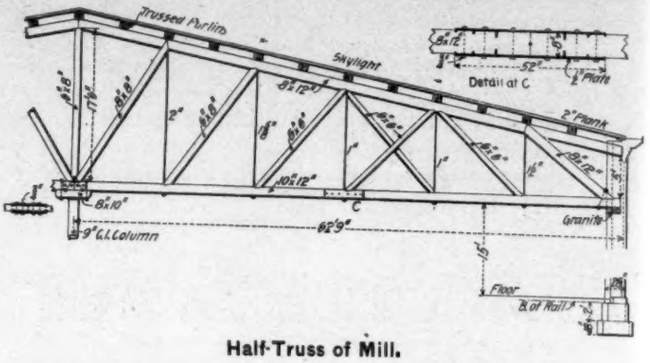

Slate
East'n Granite Roofing
Note: Arrangement of rooms on 2nd. floor same as first, with the absence of the Toilet Rooms.
Platform 4' above base of rail
Fire Proof Store Room 25'x 73'
25' Cts
275'x 73'- Floor 4' above base of rail.
Toilet Room
Lockers
Office 40'x 36'6"
Floor - Natural Earth, 6" Concrete, 1" Cement.
Office 25'x 29'
Office 25'x 29'
75'6"
350'

Storehouse and Offices.

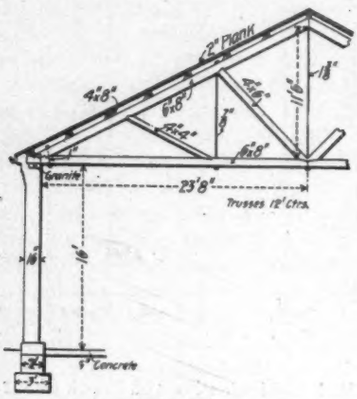
Readville Car Shops.—New York, New Haven & Hartford Railroad.



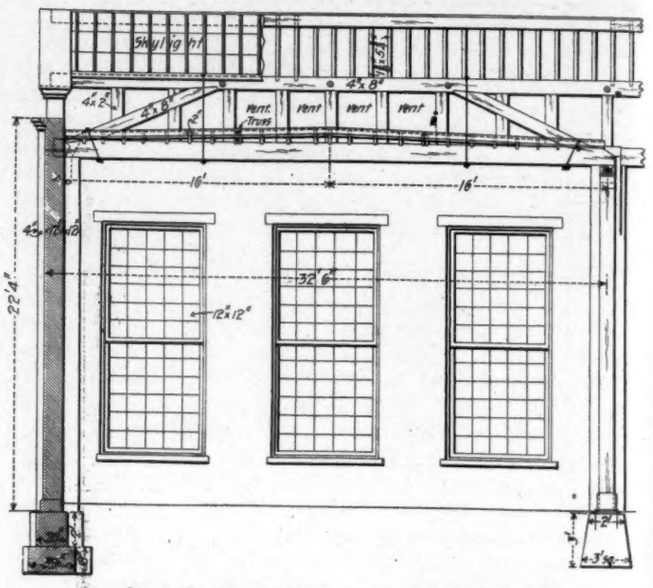
Dry Kiln.



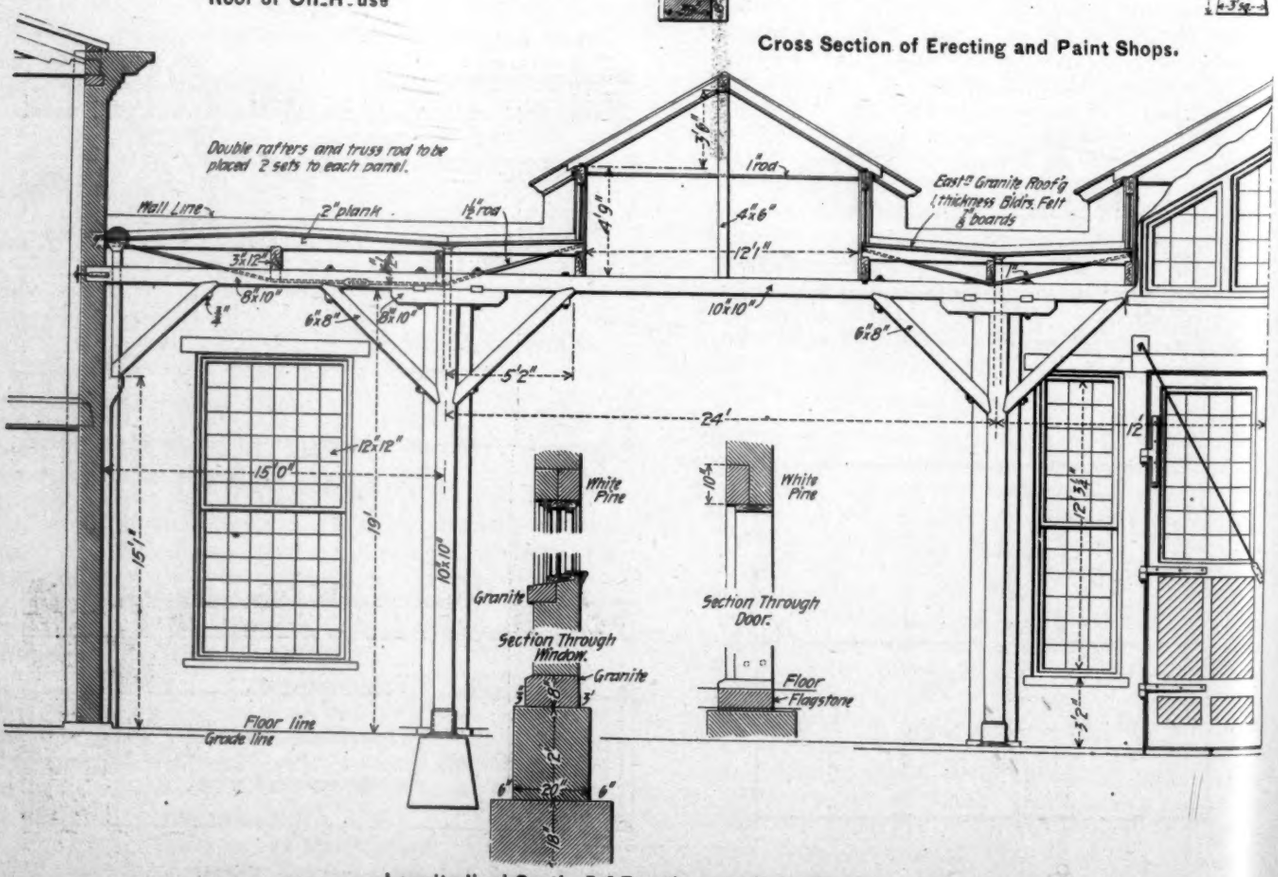
Half-Truss of Mill.



Roof of Oil House.

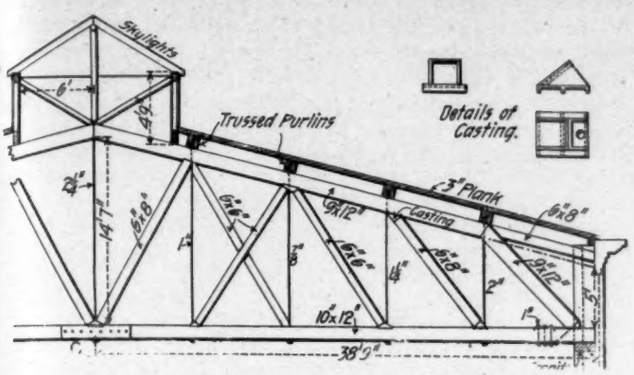


Cross Section of Erecting and Paint Shops.

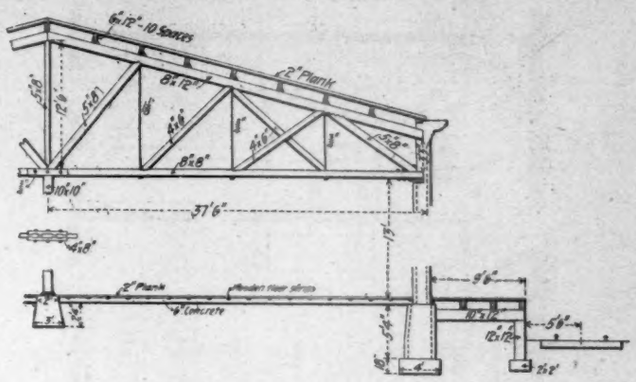


Longitudinal Section of Erecting and Paint Shops.

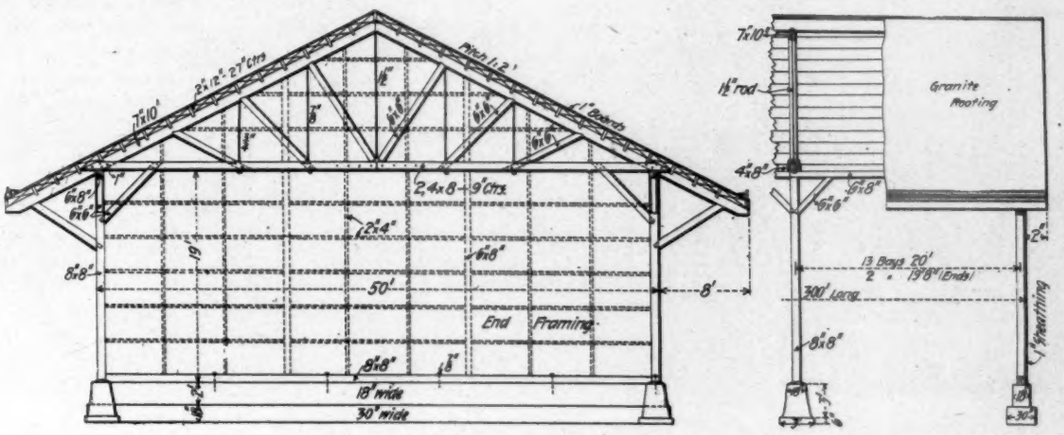
Readville Car Shops—New York, New Haven & Hartford Railroad.



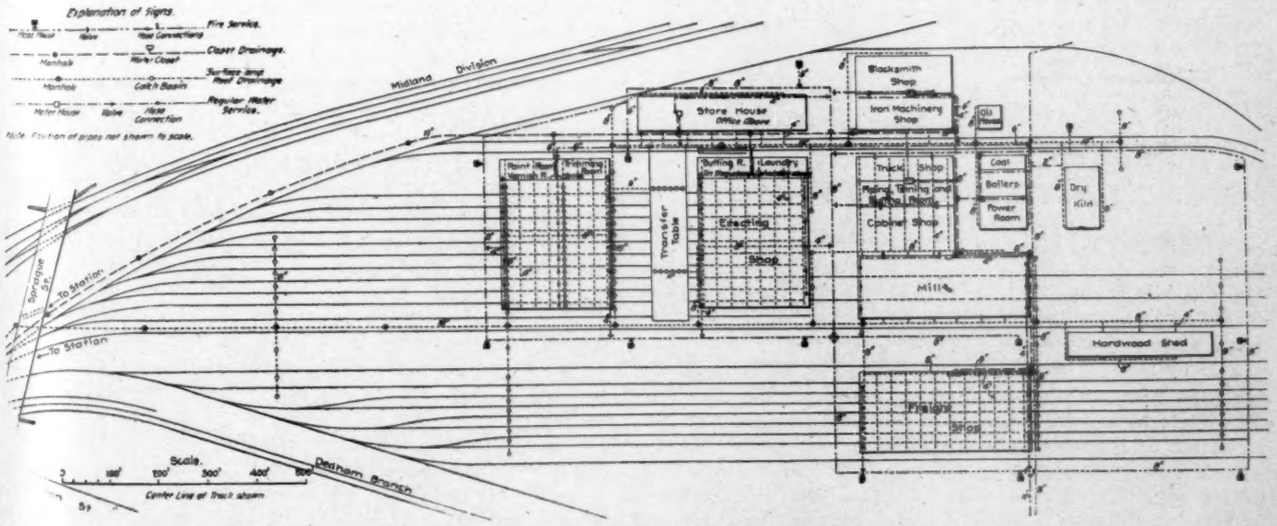
Roof of Blacksmith and Machine Shops.



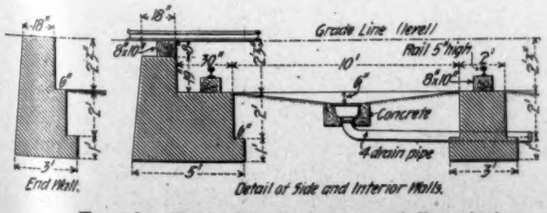
Roof and Floor of Storehouse.



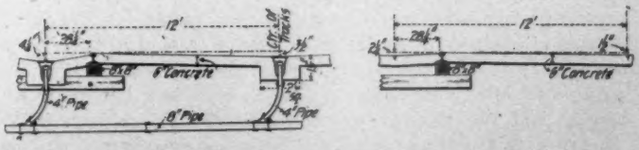
Hardwood Storage Shed.



Pipe Plan for Water and Drainage.

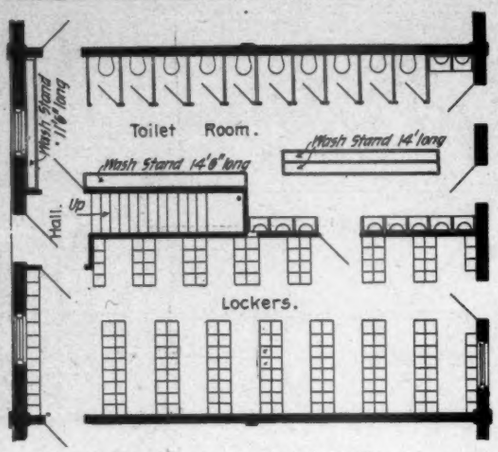


Transfer Table Pit, Drainage and Foundations.

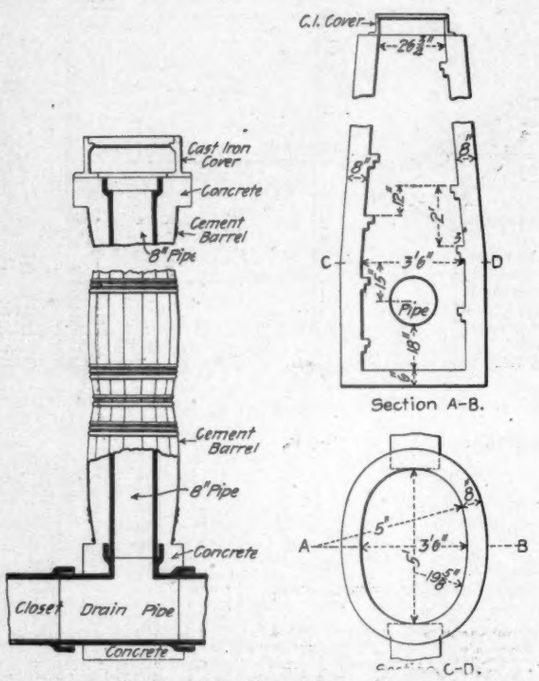


Floor Sections in Paint Shop.

Readville Car Shops—New York, New Haven & Hartford Railroad.



Toilet Rooms in Erecting Shop.



Sections of Man and Lamp Holes.

bers are anchored by 1 by 16-in. drop bolts placed about 10 ft. apart.

A dry kiln 75 by 125 ft. is necessary at this plant because of the large amounts of lumber used. It is built with 12-in. brick walls and divided into rooms by fire walls.

A 20 by 25-ft. extension outside of the kiln provides for the fan from which the heated air is circulated through two 3 by 2-ft. ducts under the floor. In order to dispose of the condensation of moisture from the drying wood a large surface of cold-water piping is provided from which the drip is conducted outside of the building. A substantial framing of 12 and 18-in. I beams resting on cast-iron columns supports the upper tiers of drying lumber. There are two standard-gauge tracks running into and through this building, this being another example of the plan of the shops whereby progressive movements were sought in all operations.

A detail worthy of notice is the use of cast-iron post shoes on sockets to receive the lower ends of the roof posts in the paint and erecting shops. These have broad bases 18 ins. square and are secured to the foundations by ⅞-in. bolts. The sockets are 12 ins. deep and serve as a safeguard against displacing the posts by accidental collisions in the shops.

In order to save the reader's time the drawings are made to explain a number of features of construction which it does not seem necessary to mention in detail, such as the forms of the roof trusses, the thickness of walls and height of the buildings under the trusses. The power plant and machinery will require an article by themselves and will be described later. The contractors for the buildings are Messrs. Horton & Hemingway, of Boston. The contracts for the equipment of the buildings are not yet awarded.

LOCOMOTIVE TRACTION INCREASERS.

About fifteen years ago traction increasers in the form of devices for temporarily transferring a portion of the weight of the tender to the driving wheels were quite common, but they soon became unpopular and disappeared from practice. They were generally applied to remedy defects in design, or "over-cylindered" engines. A committee reporting to the Master Mechanics' Association in 1887, and again in 1888, brought out unfavorable opinions and until very recently nothing more was heard of the subject. Under the conditions prevailing at that time a heavy boiler was undoubtedly the best possible traction increaser and this holds good up to the time when the limits of weight are becoming troublesome.

Interest in traction increasers is again awakened by the application of the old idea in a new way on the new locomotives built by the Schenectady Locomotive Works for the New York Central and illustrated in our February number. In this case the additional weight on the driving wheels is obtained by moving the fulcrums of the rear equalizers, and transferring about 12,000 lbs. from the trailing and truck wheels. This is to be used only at slow speeds and it is not believed to endanger the springs; neither is it likely to squeeze out the oil from the driving journals, because these are made 9½ by 12 ins., presumably to guard against the effect of this additional temporary load.

The present reasons for applying the device are entirely new; they arise from a desire to use a four-coupled engine for work which may at times be beyond the capacity of four-coupled wheels unless loaded beyond the limits of weight considered by the engineering department as safe for the bridges. This is equivalent to saying that this use of the traction increaser is to avoid six-coupled wheels and to make the "Atlantic" type do the work of either the ordinary 10-wheel type or other types using 6-coupled wheels.

The traction increaser may have an important influence on passenger locomotive design, for, if successful in extending the field of the four-coupled engine, its use will become general, and if not successful it will lead at once to the conclusion that six-coupled engines are necessary for heavy and fast passenger service. By this we mean fast trains of from 13 to 16 cars. It would be pure presumption to express an opinion on the question now, but the opportunity for comparing the two ideas is at hand in the cases of the New York Central and Lake Shore engines, both of which are magnificent in their proportions and power. One stands for the "Atlantic" type with high boiler power and temporary facilities for increasing the starting power, while the other represents almost the same boiler power, but large tractive weight available all the time. There is no choice in the number of wheels and the complication of the traction device in the one case is balanced against the extra pair of driving wheels and side rods in the other.

These two locomotives are believed to be the most important which have appeared in many years. They bring up the important question: "What next?" In view of the fact that the New York Central engine is not expected to haul trains of over ten cars, it is wise for roads having to deal with heavier trains, which are constantly increasing in weight, to carefully consider the problem which the traction increaser introduces. It should not be forgotten that the latest Pullman cars weigh 125,000 lbs. and that engines now new will be in service for twenty years.

COMPOUND CONSOLIDATION FREIGHT LOCOMOTIVES WITH WIDE FIREBOX.

New York Central & Hudson River Railroad.

Built by Schenectady Locomotive Works.

Through the courtesy of Mr. A. M. Waitt, Superintendent of Motive Power of the New York Central and the builders, we illustrate a new compound freight locomotive known as the "Central Consolidation." This is a two-cylinder compound of the Schenectady Locomotive Works type, with a wide grate, large boiler and 210-lb. boiler pressure. Mr. Waitt is convinced of the value of large boiler capacity and in this engine has continued the policy of considering the design of the firebox from the standpoint of the fuel. The combination of large grates and compound cylinders with a large boiler should produce an engine capable of handling heavier trains than any other engine on the road. While this was desired the supply of reserve power for dealing with heavy trains in winter as well as summer was the vital question, as it is usually the combination of heavy traffic and cold weather that makes reserve capacity so desirable. This engine is intended to haul the heaviest trains handled by the present types of moguls on this road in summer and then be capable of hauling them in the worst winter weather. One of these engines has been built and 10 more will follow, but the latter installment will have 72-in. boilers, larger heating surfaces and 34 instead of 32-in. stroke, as it was found that the addition of two more wheels to the mogul design would permit of these additional contributions to the desired capacity. We present the leading dimensions of the new engine here, to be followed later by a description of the heavier class. This appearance of the compound on the New York Central is understood to be an indication that the experience with the compound mogul, which has now been in service for about a year, has been so satisfactory as to lead to a much larger scale of experiment. This engine has 63-in. driving wheels, this dimension being decided upon because it gives an increase of speed of about 5 miles per hour over a 57-in. wheel without increasing the speed in number of revolutions.

The following list of particulars will convey a good idea of the engine:

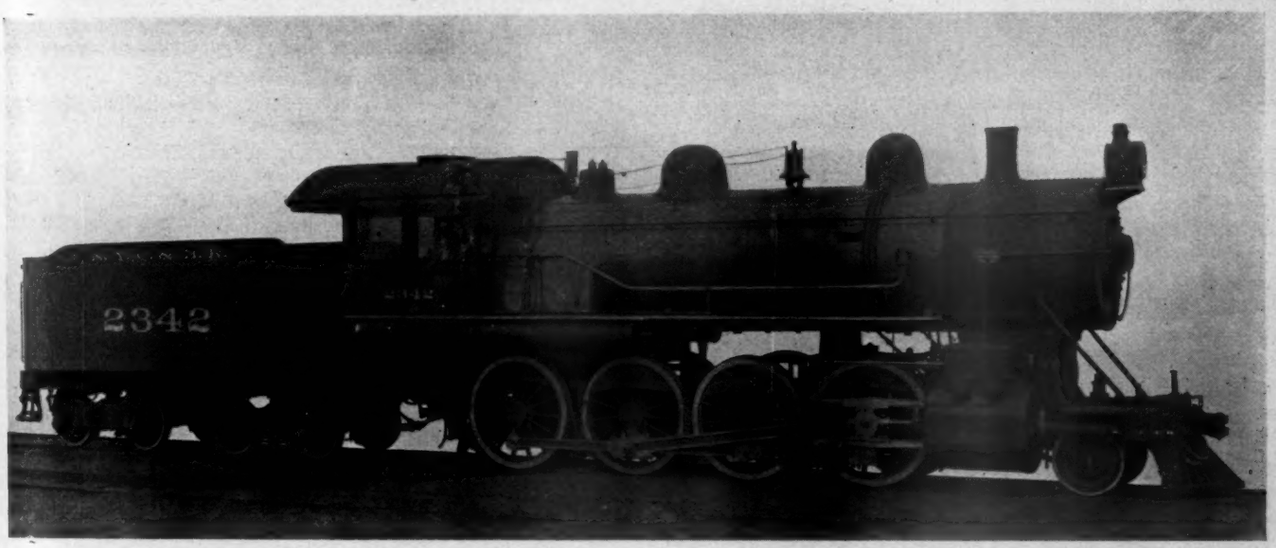
COMPOUND CONSOLIDATION LOCOMOTIVE.
New York Central & Hudson River R. R.

General Dimensions.

Gauge	4 ft. 8½ ins.
Fuel	Bituminous coal
Weight in working order	190,000 lbs.
Weight on drivers	164,000 lbs.
Wheel base, driving	17 ft. 0 in.
Wheel base, rigid	17 ft. 0 in.
Wheel base, total	25 ft. 9 ins.

Cylinders.

Diameter of cylinders	H. P. 23 ins.; L. P. 35 ins.
Stroke of piston	32 ins.
Horizontal thickness of piston	H. P. 4⅜ and 5¾ ins.; L. P. 4⅛ and 5¼ ins.
Diameter of piston rod	4 ins.
Kind of piston packing	Cast iron rings



COMPOUND CONSOLIDATION FREIGHT LOCOMOTIVE—NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

A. M. WAITT, *Superintendent of Motive Power.* SCHENECTADY LOCOMOTIVE WORKS, *Builders.*

Cylinders: 23 and 35 by 32 in.			Boiler Pressure	210 lbs.	
Wheels: Driving	63 in.;	engine truck	33 in.;	tender wheels	33 in.
Weights: Total of engine	190,000 lbs.;	on drivers	164,000 lbs.;	weight of tender empty	46,800 lbs.
Grate area and tubes: Grate area	50.31 sq. ft.	Tubes			365 2 in. 16 ft. long.
Firebox: Length	96 in.;	width	75⅝ in.;	depth of front 71 in.;	back 61 in.
Boiler: type, straight	radial staying.			Diameter	70 in.
Heating surface: Tubes	3,040.81 sq. ft.;	firebox	176.32 sq. ft.;	total	3,217.13 sq. ft.
Wheel base: Driving	17 ft. 0 in.;	total of engine	25 ft. 9 in.;	engine and tender	53 ft. 9 in.
Tender: Eight-wheel;		water capacity	5,000 gals;	coal capacity 10 tons.	

Size of steam ports	L. P. 23 by 2⅛ ins.
Size of exhaust ports	L. P. 23 by 3 ins.
Size of bridges	L. P. 1⅜ ins.

Valves.

Kind of slide valves	H. P. piston type; L. P. Allen-Richardson balanced
Greatest travel of slide valves	6 ins.
Outside lap of slide valves	H. P. 1¼ ins.; L. P. 1 in.
Inside clearance of slide valves	H. P. ⅛ in.; L. P. ¼ in.
Lead of valves in full gear	1/32 in. blind

Wheels, Etc.

Diameter of driving wheels outside of tire	63 ins.
Material of driving wheel centers	Cast steel
Tire held by	Shrinkage
Driving box material	Cast steel
Diameter and length of driving journals	9 ins. dia. by 12 ins.
Diameter and length of main crank pin journals,	Main side, 7½ by 5¼ ins.; 6½ ins. dia. by 6 ins.
Diameter and length of side rod crank pin journals,	Inter 5½ by 4¾ ins.; F. & B. 5 ins. dia. by 3¾ ins.
Engine truck, kind	Two-wheel, swing bolster
Engine truck, journals	6¼ ins. dia. by 10 ins.
Diameter of engine truck wheels	33 ins.

Boiler.

Style	Straight, with wide firebox
Outside diameter of first ring	70 ins.
Working pressure	210 lbs.
Material of barrel and outside of firebox	Carbon steel
Thickness of plates in barrel and outside of firebox,	⅜ in., ½ in., ⅝ in. and 13/16 in.
Horizontal seams	Butt joint, sextuple riveted, with welt strips inside and outside
Circumferential seams	Double riveted
Firebox, length	96 ins.
Firebox, width	75⅝ ins.
Firebox, depth	Front, 71 ins.; back, 61 ins.
Firebox plates, thickness	Sides, 5/16 in.; back, ⅜ in.; crown, ⅜ in.; tube sheet, ½ in.
Firebox, water space	Front, 4 ins. and 5 ins.; sides, 3½ ins. and 5½ ins.; back, 3½ ins. and 4½ ins.
Firebox, crown staying	Radial stays, 1⅛ in. diam

Firebox, staybolts	1 in. diam.
Tubes, material	Charcoal iron No. 12 B. W. G.
Tubes, number of	365
Tubes, diameter	2 ins.
Tubes, length over tube sheets	192 ins.
Fire brick, supported on	Water tubes
Heating surface, tubes	3,040.81 sq. ft.
Heating surface, water tubes	28.27 sq. ft.
Heating surface, firebox	148.05 sq. ft.
Heating surface, total	3,217.13 sq. ft.
Grate surface	50.31 sq. ft.
Grate, style	Rocking, N. Y. C. standard
Ash pan, style	Hopper
Exhaust pipes	Single
Exhaust nozzles	5¼ ins., 5½ ins., 5¾ ins. diam.
Smoke stack, inside diameter	15½ ins. and 14 ins.
Smoke stack, top above rail	14 ft. 9 ins.
Boiler supplied by	Two Nathan & Co. "Monitor" injectors, No. 10

Tender.

Weight, empty	46,800 lbs.
Wheels, number of	8
Wheels, diameter	33 ins.
Journals, diameter and length	5 ins. dia. by 9 ins.
Wheel base	16 ft. 6½ ins.
Tender frame	10-in. steel channels
Tender trucks	Fox pressed steel, bolster type
Water capacity	5,000 U. S. gals.
Coal capacity	10 tons
Total wheel base of engine and tender	53 ft. 9 ins.

Special Equipment.

Westinghouse-American combined brakes on drivers, tender and for train.
Westinghouse 9½-in. L. H. air pump.
Westinghouse air signal.
National hollow brake beams on tender.
Franklin sectional lagging on boiler and cylinders.
Gould coupler at front of engine and rear of tender.
Leach sand feeding apparatus.
Water scoop on tender.

What is probably the largest single shipment in the history of Southern railroads is now being moved over the Louisville & Nashville from Mount Pleasant, Tenn., to Pensacola, Fla., to be forwarded to Cuba. It consists of 2,000 carloads of rock phosphate, all in one consignment, and the magnitude of the undertaking is shown in the fact that the railroad company is under contract to deliver 200 carloads of the freight daily.

Honorable Charles A. Prouty, member of the Interstate Commerce Commission, delivered on January 21 an address before the engineering students of Purdue University. His subject was "The Relation of the Railways to the People," which he treated by presenting in outline the work of the Interstate Commerce Commission. Mr. Prouty began by calling attention to the great influence exerted by American systems upon the progress of the country and discussed the important part played by railway rates in the development of commerce. He showed how the magnitude of the interests involved demands governmental regulation of rates, and in this connection explained the work of the Interstate Commerce Commission, which is charged with the duties of supervising and regulating such affairs. The discussion was entirely impartial and was much enjoyed by the student body who were privileged to hear it.

MASTER MECHANICS' ASSOCIATION SCHOLARSHIPS.

There is now one vacancy in the Master Mechanics' Association scholarship at Stevens Institute of Technology and in June, after the graduation, there will be another. The spring entrance examinations will be held at the Institute in Hoboken, June 18 to 22 next. Candidates for the scholarships should apply to the secretary of the association, Mr. J. W. Taylor, 667 The Rookery, Chicago. The candidates for the June examinations must be sons of members or deceased members of the association, and if such do not appear for the examination the sons of other railroad employees of the mechanical department may apply for the fall examinations. The successful candidates are required to take the course in mechanical engineering. We hope soon to hear that there are young men on the waiting list for these opportunities. It seems incomprehensible that such chances for a good education should go begging for applicants.

AIR BRAKE "SKIPPING" TESTS.

These tests, which show under various conditions the limiting number of successive cars in a train which may be cut out of the air-brake service without destroying the emergency feature of the quick-acting air brake, were made upon the Master Car Builders' air-brake testing rack in the engineering laboratory of Purdue University, under the direction of Richard A. Smart, Associate Professor in Experimental Engineering, and published in the January issue of the "Railroad Digest." The failure of this emergency feature of the air-brake valve to act on those cars following an excessive number of cut-out cars is shown in these tests, and also that the number of cut-out cars can be greater at the middle and end of a train than immediately back of the tender. This is accounted for by the fact that after the emergency application has passed a number of cut-out cars in the front part of the train, the sharpness in drop in the train-line pressure is considerably reduced by the air rushing forward from the back end of the train line. It is not uncommon to see several cars, by reason of defective air-brake rigging, cut out and grouped together in different parts of a train, and it is here that it is important to know how many successive cars of this description the emergency action will skip and the best location for these cars in a train. Of the 42 tests or groups of tests that were made, 25 were with a train of thirty cars and 17 with a train of fifteen cars. The train-line pressure, with the exception of a few tests, was kept at 70 lbs., the piston travel at 8 ins., and for each of the 42 tests three applications were made. With the cut-out cars of the longer train alternately grouped in twos and threes throughout the whole length, the emergency action skipped as effectually with cars 1, 2 and 3 constituting the first group cut out as when cars 4, 5 and 6 were the first group. The greatest number that could be skipped immediately in front of the last car was nine, while with the same number cut out immediately in front of the last two cars, the quick action failed to reach the end car. In the middle of the train three cars was the limit that could be cut out. Two tests with a train-line pressure of 45 lbs. limited the number of cars that could be cut out to 8 at the end, and, alternately throughout the train, groups of two cars. Results from several tests using a 12-in. piston travel and train-line pressure of 70 and 45 lbs. were substantially the same as with a piston travel of 8 ins. and pressure of 70 lbs. With the fifteen-car train, three cars at the front and eight at the end was the limit that the emergency action would skip.

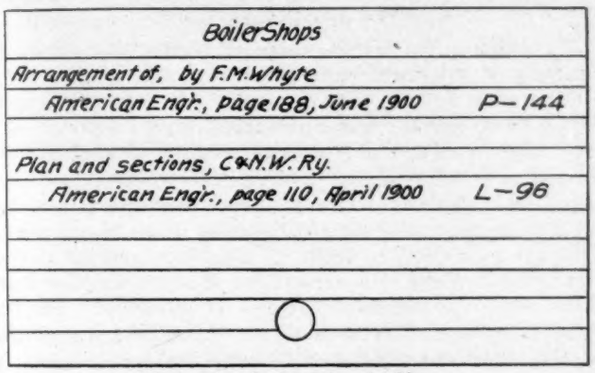
Successful wireless telegraphy over 200 miles is announced by Prof. J. A. Fleming, of London University. In a lecture delivered in Liverpool February 12, he stated that he had Marconi's permission to report that on the first day of the reign of King Edward VII. Marconi had sent messages from St. Catherines to the Lizard, a distance of 200 miles, and that a perfect wireless communication had been established between those points.

Depreciation of machinery is treated in a recent article by Mr. R. H. Smith, in "Feilden's Magazine" (Volume, 1900, page 270). The depreciation of a machine in the course of one year is the change in the capitalized present value of its net earning power, taking into account the probable duration of its remaining life. The capitalized value of the earning value of a new machine is, if it be well chosen and skilfully placed, more than its money cost by the value of the intelligence employed in selection and placing. A mathematical expression is obtained for the depreciation of the present intrinsic and extrinsic value, and curves are plotted from which it is clear that the prevalent notion of decreasing the rate of depreciation toward the end of a machine's life is erroneous; such yearly depreciation should increase.

THE BUSY MAN'S FILING SYSTEM.

Nearly every engineer, whether connected with a railroad or manufacturing company, has some system of filing and indexing technical and professional information, and if he has not, will sooner or later feel the need of it. Some of the methods used are simple and serve their purpose well and, again, there are others that are not reliable, nor do they give ready access to the information sought.

Mr. R. H. Soule, Consulting Mechanical Engineer, New York, is using a system of filing to which he has given considerable thought. This method is reliable, easy of operation and is very flexible. It is not enough that an index and file should serve its purpose now, but it must be flexible in the sense that it can be developed, without any change, into a very extensive system. It has been found that three sizes of file boxes, 7 x 10 x 2½ ins., 9½ x 12¾ x 2½ ins. and 11½ x 16½ x 2½ ins., inside dimensions, constructed similar to the "National Receiving Case," but without a plate or rod in the back of the box,


Boiler Shops
Arrangement of, by F.M. Whyte
American Engr., page 188, June 1900 P—144
Plan and sections, C&N.W. Ry.
American Engr., page 110, April 1900 L—96

Index Card—3 x 5 ins. in Size.

will accommodate the various sizes of papers, pamphlets and trade catalogues with the least waste of space. These boxes are designated by the arbitrary letters P, L and G respectively. The small file, P, is the right size for the general run of pamphlets, such as the railroad club proceedings, trade catalogues, etc., the intermediate size, L, is the most convenient for letterheads and the majority of technical papers, and the larger size, G, admits of filing the pages of the largest technical papers. These file boxes fit into a case made of plain wood, stained, and having four shelves just large enough for six files on a shelf. The first two shelves are used for the size P, the third for L and the fourth for G. For convenience in taking the files from the case small leatner pull tags are fastened to the front of each box about 3 ins. from the bottom.

The location of each item of information placed in these boxes is typewritten on regular Library Bureau cards and grouped alphabetically under separate headings in a hard-wood index case, having two drawers. In looking for information, say, for example, on railroad boiler shops, the first step is to look in the index for the cards on "shops," which are separated from those on other subjects by a division card called a buff third and having the subject "Shops" written in the upper left-hand corner. If it is a reference to boiler shops which is desired, the card, being in alphabetical arrangement, will be quickly found. In the upper right-hand corner of the accompanying engraving of this card will be found the number and size of box containing the reference, which we will say is P—144. Each box as it is filled is marked on the front cover in large figures, the lowest and highest number given to the items filed in that box. It is then only a matter of turning to the given number in the file, which is marked in the upper right-hand corner of the book or clipping, together with the letter indicating the size of box. It is often necessary to cross-index an article; for instance, the subject of Electric Power Distribution at the Westinghouse Works will have one card. In that particular article tests of electrical and steam distribution at these works may be given, which would need a second card, so that one article may have a number of cards referring to it and again one card may contain four or five references to different articles. When indexing articles not found in the files, such as contained in the "British Institution of Mechanical Engineers," the volume, page and year are also added to the card and in the upper right-hand corner, in place of the usual file number, is put a zero, indicating that that reference is not in the file. For small clippings not up to the standard size, it is convenient to have a few manila sheets for the purpose of mounting these clippings.

The cost of such a system complete is as follows:

The Cost.

1 card index, cards and case	$9.00
12 small file boxes, at 35 cents	4.20
6 medium file boxes, at 40 cents	2.40
6 large file boxes, at 50 cents	3.00
100 manila sheets	.50
1 plain stained book case	4.50
Total	$23.60

When going through papers, pamphlets, etc., Mr. Soule checks with a blue pencil the articles worthy of record and the pamphlets are afterward cut up and the pages not containing the marked articles are destroyed, the remaining sheets of each paper, or in some cases two or three papers, are bound with metal binders and the whole document given the next higher number in the proper size file box. It is not necessary to make out a card for each article as it is numbered and ready to file, but this can conveniently wait until a number of articles have accumulated. The whole secret of keeping any filing system up to date is to mark the articles and get them ready for filing the first time they come to notice and every little while indexing and placing them in the proper files. The strong point about Mr. Soule's system is that the work is never done over again. The system is good indefinitely and the clippings may always be found from the cards. A card index system seems necessary to a logical plan, because frequently a single clipping may refer to a number of entirely different subjects, and with only one clipping it is impossible to find it under more than one head if it is placed in a box or envelope devoted to a single subject. The editors of this journal have adopted Mr. Soule's plan and find it satisfactory in every way.

According to statements attributed to President Newman, of the Lake Shore, improvements decided upon for the Lake Erie & Western when completed will make it second to no other road in Indiana, Ohio or Illinois. These include new steel rails, 70 lbs. to the yard, on the entire line, with new ties and heavy ballasting, rebuilding of bridges and lengthening of sidings so that the movement of trains can be expedited. No road in the Central Freight Association, Mr. Newman says, all conditions considered, is showing as large proportionate increase in earnings as the Lake Erie & Western. The relaying of the main line with new rails will take about two years.

American and English locomotives formerly differed but little in size and weight, but of recent years this has changed in a remarkable way. English designers now turn toward our practice for suggestions in the direction of increasing capacity and we can profitably turn to them for ideas in connection with getting the utmost out of each ton of weight. The following very sensible quotation from "The Engineer" (London) would be equally appropriate if reversed as to countries and applied to the adjustment of the elements to each other instead of size: "Is there, then, any reason why we should not resort more fully than we have yet done to American practice in designing the extremely powerful locomotives which the exigencies of modern traffic demand? We do not for a moment suggest that we should slavishly follow any example, or copy any locomotive; but when designing locomotives, British engineers may, we think, find in American practice direct and substantial proof that certain things may be done, the success of which might otherwise be doubtful."

(Established 1832

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING PAGES. *The reading pages will contain only such matter as we consider of interest to our readers.*

Special Notice.—*As the* AMERICAN ENGINEER AND RAILROAD JOURNAL *is printed and ready for mailing on the last day of the month, correspondence, advertisements, etc., intended for insertion must be received not later than the 20th day of each month.*

Contributions.—*Articles relating to railway rolling stock construction and management and kindred topics, by those who are practically acquainted with these subjects, are specially desired. Also early notices of official changes, and additions of new equipment for the road or the shop, by purchase or construction.*

To Subscribers.—*The* AMERICAN ENGINEER AND RAILROAD JOURNAL *is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified, so that the missing paper may be supplied.* **When a subscriber changes his address** *he ought to notify this office at once, so that the paper may be sent to the proper destination.*

The paper may be obtained and subscriptions for it sent to the following agencies: **Chicago,** *Post Office News Co., 217 Dearborn Street.* **London, Eng.,** *Sampson Low, Marston & Co., Limited St. Dunstan's House, Fetter Lane, E. C.*

The desirability of securing more commodious quarters for the American Society of Mechanical Engineers has long been appreciated by a large number of the members, and the temptation to follow the example of the foreign engineering institutions and the American Society of Civil Engineers in undertaking the responsibilities of a fine new building is undoubtedly strong. In an able editorial "Engineering News" comments upon the fact that the present quarters are too small for the opening meeting of each annual convention and advances arguments in favor of arranging to accommodate the mechanical engineers in the fine new building of the American Society of Civil Engineers in New York City, where there is said to be room for both. Such a movement should be slow. The mechanican engineers have been successful and have won a high place. They will advance much farther and become more influential by continuing their present state of absolute independence and any attempt to share with another organization a building not specially constructed for the needs of both is sure to be uncomfortable for the one which must be satisfied with the subordinate position. There is a homelike comfort about the society rooms on Thirty-first street which goes far to make up for the lack of room on the single night of the entire year when they are too small, and it would seem unwise to make an unsatisfactory arrangement merely on account of that one evening. For a number of years the society may hold its opening session in a convenient hall, and when ready, the house question can be taken up as it should be, independently. It is hardly time to do this yet, because there are other and more important directions in which the energies of the organization should be exercised.

In June there will be two vacant scholarships of the Master Mechanics' Association in Stevens Institute of Technology at Hoboken. Mr. J. W. Taylor, Secretary of the Association, whose address is 667 The Rookery, Chicago, will supply information. These opportunities are offered first to sons of members of the association and afterward to the sons of employees of the mechanical department in case there are not enough applicants of the preferred class. It is difficult to understand why there are not more applicants for these scholarships. Members of the association should post bulletins in the shops to inform their young men about them.

A horizontal increase in wages is usually included in the demands of grievance committees, particularly those representing shop forces. This is usually one of the first problems a newly appointed superintendent of motive power meets if he comes from another road, and unless he is a close student of men he is likely to meet it often. On two roads having recently come under our notice, grievance committees are part of the past, because there are no grievances of the men in classes. This has been brought about by developing individual effort among the men and by placing the premium of increased wages upon merit. A horizontal increase is generally unwise, because it affects the worthy and unworthy alike, and it is likely to lead to strike after strike simply because the men are dealt with in classes. It is better to raise the wages of a good man in a group as a reward of good work. This will bring others to the foreman with claims of equality with the one who has been advanced. The reply may then be: "Yes, you are perhaps as good in every way as he; but the only way I can judge is by the results. Show that you can do as much and as good work as he and I will raise your wages in the same way." If such a plan is systematically practiced, with care and discrimination, there will probably be nothing for a grievance committee to do. This is the result on the two roads referred to. Shopmen are usually ready to respond to perfectly fair treatment. Much thought and study are needed in the handling of men, and it is safe to say that not all of the difficulties with shop labor are unavoidable.

Progress in passenger locomotive design is strikingly illustrated in this journal by the descriptions of the new Lake Shore, Union Pacific and New York Central engines, all of which are noteworthy and all aim at the utmost possible capacity and sustained power, although the conditions on these three roads are not at all alike. These engines are by three different builders and represent the views of different men, but they all show the desire to secure the greatest possible reserve power for emergencies.

The Union Pacific engine is very heavy, and but 1,080 lbs. lighter than the new consolidation freight compounds of that road illustrated in January. A mere accident in the drawing room might have reversed this order and made the passenger engine the heavier. This fact is evidence of the appreciation of great boiler power. The new Class "J" Lake Shore engine is bold throughout in its wheel arrangement and boiler design, its 19-ft. tubes and wide grate. With its combination of wheels, radial trailer trucks, wide grate, long tubes and large heating surface it is the most notable engine of the year and one from which great results may be expected.

Another novelty is the traction increaser of the new Atlantic type of the New York Central. With a large grate and heating surface and the possibility of increasing the adhesive weight in starting, this engine will be watched with great interest for excellent results. It is becoming more and more evident that the limits of capacity are yet a long way off and they appear to recede as the possibilities of increased power develop. The four-cylinder compound with divided cylinders, balanced as in French practice, is yet to be tried. At the present rate of progress we may see it sooner than we expect. At all events it is pretty well established that the compound of the future will have four cylinders. There would be no hazard in fitting the New York Central and Lake Shore engines with tandem compound cylinders.

THE FATE OF A DRAFTSMAN.

Last month in these columns a young man, promoted from the drafting room, was spoken of as having been saved from the death of a draftsman. The amount of correspondence occasioned by the expression is sufficient to indicate the necessity for saying more upon the subject.

In too many cases the drafting room is a side track into which good men hesitate to enter, and though the temptation to go into details is strong this is the fact to which attention is specially directed.

In a single week our correspondence includes three cases, any of which amply justifies these paragraphs. The first disclosed a vacancy for a first-class draftsman with technical education and training, salary $80 per month, hours 7 a.m. to 6 p. m., with half hour for lunch. The second required an exceptional man with "college education and shop apprenticeship," and one thoroughly familiar with locomotive design and foundry work, the salary being the same as the first, but it was expressly stated that there was no hope for advancement. The third opportunity was for a chief draftsman at $100 per month. This was clearly stated to be the limit of the position and salary, and it seems that the salary was fixed by a power above the mechanical department. Naturally, a man was not expected to stay more than a few years in the position or to get more out of it than experience and education for use elsewhere.

These and other records at our elbows indicate that the railroad mechanical draftsman has a hard time; they show how difficult it is to get good men and the reasons. During the past year there have been many calls for draftsmen and we have supplied a number of good men, but does not the very demand for men in itself indicate a solution of the whole difficulty? If the drafting room was considered a step in advancement toward other important positions, and if it was used to develop men, or rather to enable them to develop themselves, it would be full of men prepared for advancement and equipped for greater responsibilities. It is argued that railroads are not training schools, but this does not appear to be true. If drafting rooms are to have good men they must make them. One who, as a rule, looks outside of his own organization for men ready trained to his hand, is likely to be frequently disappointed and he will always be looking for men. That organization is best and most successful which best provides for its own perpetuation.

What may the drafting room offer that will attract the right kind of men, and keep them? What should the men do to place their work in an advantageous position before their superiors and lead to the proper appreciation of the department? These are questions worthy of thought on every railroad.

There is no better experience in the motive power department than that of the draftsman who is encouraged and allowed to follow up his work. There is no better place than the drafting room in which to gain an appreciation of the commercial questions which are so vitally important, and, all things considered, this department ought to broaden and develop men. There is no better way to develop ability to take responsibility than by designing in this department. Its tendency, however, is almost altogether away from executive experience, but there is no reason to believe that a successful draftsman is necessarily a poor executive. He cannot be a good one unless given the opportunity, and we answer the first of these questions by suggesting an outlet to the talent of the drafting room. Give the men a little hope that they may go higher if they can show their ability. One good way to encourage them, and it will pay, is to give them a whole day every month in which to visit the shops or places where the results of their work are in use. Informal reports of these days, with suggestions, would be valuable to all concerned, and it would be easy, through them, to study the men with a view of making them still more useful. Do not consider this a vacation, but one of the draftsman's duties.

Because of his training for accuracy, his disinterestedness as well as his tendency to see things for himself rather than take the reports of others, the draftsman should be a most satisfactory investigator and observer. He will do much better work at the table for being occasionally sent away from it upon errands of investigation.

Not every draftsman will make a good foreman and some will always remain draftsmen. These should have the incentive of good salaries in order to develop their best efforts. A salary of $1,500 per year is not too much for a good car or locomotive draftsman, but the railroads do not realize this as do the locomotive and car builders. They are far below the market price for the best men and these men are not luxuries, but necessities. Prevailing rates of wages are perhaps sufficient for the ordinary draftsman, but they should have hope in one direction or the other, either in the executive work or in higher development in their present line or they will be, as many are to-day, mere machines.

To the draftsman we would say that we have no sympathy with his complaint that there is no outlet for him. He may make one if he will, though it is not provided by the policy of his superiors. A young man who is determined to rise will not be kept back, even by the drafting room. It is his fault if he does not find something on the road that needs to be done and make known his ability to do it.

If the purpose of these paragraphs is understood there is no inconsistency about them. The plea is for intelligent administration of the drafting department such as to make it an attractive opportunity for young men to gain experience and advancement, and in this way improve the average as well as the expert draftsman. On the other hand, the draftsman is urged to do his part. We are heartily in sympathy with the young men who spend their evenings on designs of their own, made to meet conditions which they see about them and know to require improvement. A superior officer must be blind indeed not to see the promise of a brilliant future in a young man who will submit such a design for criticism.

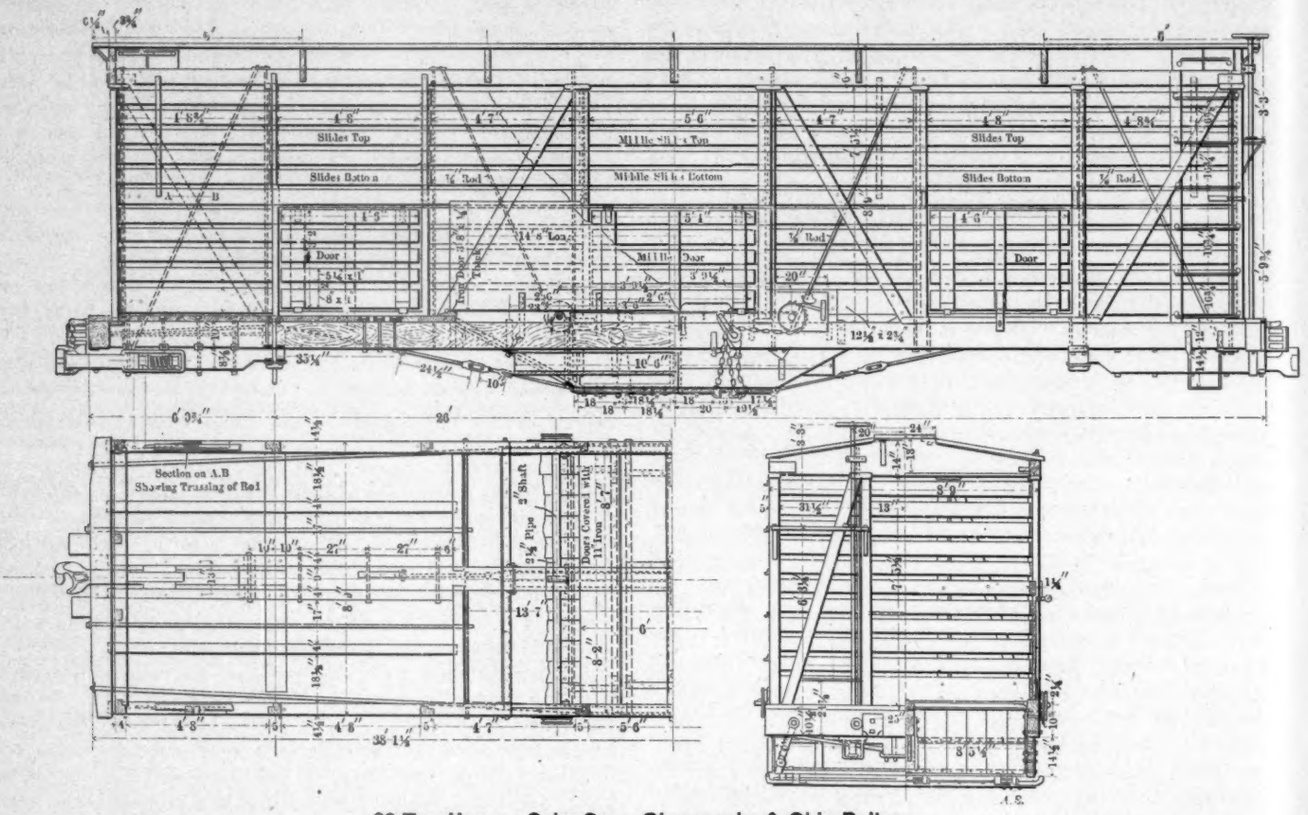
Great results may be obtained by uplifting the drafting room to a place of importance and true, practical dignity.

A remarkable record for the steam turbine of 14.174 lbs. of steam per electrical horse-power-hour delivered at the switchboard has been made by a 1,000-kilowatt Parsons turbo-generator at the Electrical Supply Works of the City of Elberfield, Germany. "Engineering," of London, in which the tests are recorded, concluded its statement as follows: "The steam turbine has had a very long fight, but it is fairly ahead of its competitors at last." It will be remembered that the best result reported for the Westinghouse-Parsons turbines at Wilmerding, and recorded on page 69 of our March, 1900, issue was 16.4 lbs. per electrical horse-power-hour.

30-TON HOPPER COKE CARS.

Chesapeake & Ohio Railway.

These coke cars were designed by Mr. W. S. Morris, Superintendent of Motive Power of the Chesapeake & Ohio, from whom we have received the drawings. They combine a number of conveniences and were evidently intended by Mr. Morris to please everybody who has occasion to use coke. They have hoppers with the usual hopper doors for those who unload on trestles, and the hopper openings may be closed by large iron plate doors 14 ft. 8 ins. long when the load is to be discharged through the sides. In each side there are three doors below the belt rail sliding bodily to one side, and above these the slats above the belt rail may be slid to one side or the other, giving ready access to the load. The upper portions of the load may be thrown out over the sides if desired.



30-Ton Hopper Coke Cars—Chesapeake & Ohio Railway.

The side and center sills are 4½ by 10 ins., the center sills being placed together with two 4 by 10-in. reinforcing sills outside of them extending to the headers at the ends of the hopper door openings. There are two through truss rods, at the side sills, and a third short truss rod under the center sills beginning about 3 ft. inside of the bolsters at each end. There is no roof, but the top rails are 3¾ by 6 ins. tied across the car by 2 by 14-in. carlines, carrying the running board. The length over end sills is 38 ft. 1½ ins., the width outside of braces 8 ft. 9 ins., and the height from the lower face of the end sill to the brake wheel is 9 ft. 11¼ ins.

Mr. Morris has about 100 of these cars in service and finds them entirely satisfactory.

A striking statement with regard to the advantages of electrical operation of turrets of war vessels is made by Naval Constructor J. J. Woodward, U. S. N., in a report on tests of the electrical equipment of the battleships "Kearsarge" and "Kentucky." The sensitiveness of the turret-turning machinery made it possible to move the turrets through an angle corresponding to but 2 ins. of an arc with a radius of 3,000 ft. It is doubtful whether such a result could be had with any other power.

ELECTRIC POWER TRANSMISSION.

The rapid strides that electricity is taking in replacing the old style of power transmission by line shafting are no longer explained by the fact that 10 to 30 per cent. of the coal bill can be saved by the installation of electric power equipment, as that saving is now realized to be a comparatively small part of the total savings in turning out finished products. This was very forcibly emphasized by Mr. Vauclain in a recent meeting of the Franklin Institute, who placed the saving in total cost, of the manufactured product of the Baldwin Locomotive Works, by the use of electric driving for tools and machines, at from 20 to 25 per cent., and stated that to replace the present system by belting and shafting would mean that 40 per cent. more floor space would be necessary in order to maintain the present output of five locomotives a day.

The general success that this system of driving has made in its comparatively short career is due principally to such marked advantages as cheaper construction of buildings; arrangement of machinery, with reference to the best light; saving in floor space and in handling of material; greater adaptability of tools to work; a freer use of overhead cranes for serving tools, made possible by clear head room; location of buildings with reference to general conveniences, rather than reference to transmitting power; freedom in the matter of extension of buildings; a more cleanly appearance and healthful condition of shops from better light and air, due to the absence of shafting and belting, which are means for continually stirring up dust; the variation and range of control of the speed of machine tools, and the saving of power. Of these the matter of speed control is unquestionably the principal advantage with many kinds of tools, for it is this facility that directly increases the output.

The following figures from the United States printing office, gathered since the installation of an electric drive in that establishment in 1895, show clearly the advantages of the electric system. The total cost of coal and gas in 1894, which was the year prior to the electric installation, was $27,811.13, and for the year 1899 was $5,614.75, leaving a difference of $22,196.38.

The growth of the office in the four years was nearly 25 per cent., which would make the sum total in the saving of fuel about $25,000; thus giving a gain of 16 2/3 per cent. on the investment, or, after a reduction of 6 2/3 per cent. for insurance, taxes and interest, there is left a clear gain of 10 per cent. The average earning capacity of each of the 100 presses was $10 per day, and for 300 working days would be $300,000. To allow a conservative estimate of 10 per cent. as the increase in production by use of electric power, would give $30,000 as a clear gain, at which rate the entire electric plant would pay for itself in five years. While the mechanical departments did not show as large an increase in production per capita as the press rooms, yet the output per square foot of floor space, with the same amount of help, was not less than 15 to 20 per cent. Mr. W. H. Tapley, of that office, says: "The benefits derived from electric power during five years of successful usage have financially purchased and maintained the entire electrical equipment."

The installation of an electric drive in shops and factories is accompanied by problems that are worthy of a most careful consideration and require good judgment. It requires a study of each kind of tool with reference to the character of work and output, and a careful selection of unit sizes. There are very few instances where electric motors cannot be used, and very many cases where the group system with each section of shafting driven by a single motor may be advantageously employed, but for all special tools and machines requiring three horse power or over, the tendency is toward the use of a separate motor for each machine. To adopt a single system of electric current for a shop or factory, from which all the apparatus can be operated demands a careful knowledge of the various machines and a proper installation to meet the work required of them.

The induction motor has advantages in the absence of a commutator, brushes and brush holders. It is very simple in construction, is cheap in first cost, and the only attention it requires is that of oiling. It runs at nearly constant speed, which offers special advantages for driving line shafting. As a system, the alternating current is without a doubt the only one for long-distance transmission, on account of the comparatively small amount of loss of power in the transmission line, and can be generated at low voltage, transmitted at high voltage and used at the motor at low voltage.

The direct current motors for independent tool driving have advantages in the ease with which they can be regulated and run at different speeds, to which the increase in output of a shop is largely due. The starting power is greater and the current required in starting is less than that of the induction motor. Direct currents are less complicated for lighting purposes than the three-phase system on account of the necessity of keeping the current equal in the three branches. The direct-current motors are not affected by wide or sudden variations in voltage and give good efficiencies.

Both the direct and alternating currents have their good points and work hand in hand for a common purpose. There are certain cases where one system is almost a necessity over another. For example, in long-distance transmission the alternating current is without question the better. The best operation for cranes, hoists and transfer tables is effected by the direct current, and for constant-potential, direct-current arc lamps have long shown themselves efficient, durable and satisfactory. The chief drawback to the direct current machine has been the wear of the commutator and the considerable attention they required. During the past few years much has been done to remedy that trouble, and motors are now being equipped with commutators which show a wear of but 1/64 in. per year and the use of carbon brushes, that wear only 1/32 to ⅜ of an inch per year. These important improvements place the direct-current motors fairly on a par with the alternating-current machines.

These opinions were expressed by different speakers in a discussion before the Franklin Institute of a paper by Mr. John F. Rowland, Jr., upon "Electric Distribution of Power in Workshops."

CORRESPONDENCE.

FREIGHT CAR PAINT.

To the Editor:

There is no small amount of complaint at the present time of the short life of freight car paint—that it becomes flat and dead, loses its gloss in a short time, in a month, in fact, and the one who complains, if he be an old man, will add that "they made better paint before the war." There is much truth in this.

From 1861 to 1865 linseed oil became scarce and high priced. As a substitute, rosin oil, diluted with coal oil, was largely sold, with the result that paint made of this oil lost its gloss in three weeks, although it started out with a fine gloss. The paint faded rapidly, checked, blistered, became soft and sticky in summer, cracked into small squares, and looked like whitewash, and was gone in two years, whereas pure linseed oil paint held its gloss for 90 days, and its only fault was the time it took to dry in.

After the war, when linseed oil came to a reasonable price, the sale of rosin oil diluted with coal oil dropped off. Taking advantage, however, of the poor drying qualities of linseed oil, manganese was added to the rosin oil mixture, and soon appeared under the name of a dryer, japan oil dryer, etc., and was again in favor, as the manganese gave up its oxygen and greatly hastened the drying of linseed oil. Rosin oil was worth probably 20 cents a gallon, and coal oil 8 cents, while manganese is very cheap, and thus railroads were induced to buy a lot of rosin and coal oil, which ruined the linseed oil paint with which it was mixed for the sake of getting a little manganese, which alone has any effect on the drying of linseed oil, which is shortened in life in proportion as anything else is mixed with it.

Linseed oil is often diluted or compounded in order to cut the straight market price on the pure article. Coal oil is very often used, and coal oil, cotton-seed oil, corn oil, etc., are always present in any paint oil pretending to be linseed oil, that is sold under the market price. Another favorite mixture is 40 per cent. linseed oil, 25 per cent. coal oil, and the balance rosin oil, with sufficient manganese to act as a dryer. In linseed oil paint any addition whatever of other oils or materials ruins the life just in proportion as they are used. A dryer is often necessary, and manganese is as cheap and harmless as anything that can be used. Railroads whose freight cars in a month look dead and flat, after being repainted, will find the trouble to be the use or mixture of rosin and oils cheaper than linseed with it, to cheapen it, or to act as "dryers."

CAR BUILDER.

RATIOS OF TOTAL WEIGHT TO HEATING SURFACE IN RECENT LOCOMOTIVES.

A correspondent in South America desires information concerning practice in this country with reference to proportions of cylinders, heating surface and grate area. The question brings out a feature in locomotive proportions which has not received much attention and is perhaps of general interest.

The following are the proportions recommended by the Master Mechanics' Association in 1897:

1. The ratio of grate area in square feet to total cylinder volume in cubic feet should not be less than 4 for large anthracite coal, 9 for small anthracite coal, and 3 for bituminous; all for simple locomotives.

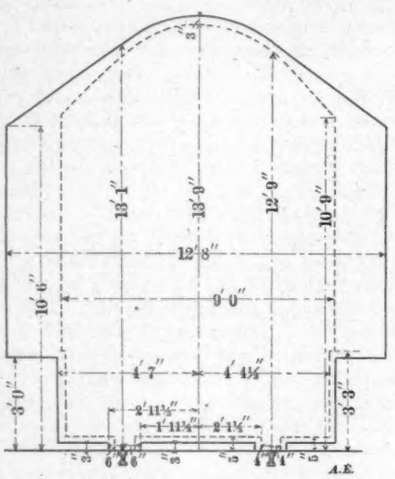
2. The ratio of heating surface in square feet to total cylinder volume in cubic feet should not be less than 180 for large and 200 for small anthracite coal, and 200 for bituminous coal; all for simple locomotives.

3. The ratio of heating surface to grate area should not be less than 40 for large and 20 for small anthracite coal, and 60 for bituminous coal, etc.

These are, no doubt, the best limits to the ratios between these factors, but there is a growing tendency to separate the question of grates from that of heating surface and cylinder capacity, and to treat each factor by itself; the cylinders with reference to the desired hauling capacity and weight, the heating surface with reference to the weight, and the grate

area with reference to the kind and quality of fuel. In several recent designs in which the maximum power was required within fixed limits of weight, the problem centered in the heating surface, and the designers tried to get as much surface as possible. The grate question was decided by the fuel and the cylinders chiefly by the work to be done. The results apparently justify the conclusion that in future the idea of following fixed ratios will be abandoned except as a mere matter of comparison. While it is not strictly true that the steam-making capacity, and, therefore, the real power of the locomotive, depends upon the extent of heating surface, there is no question of the desirability of large heating surfaces. The larger these are, providing they are effective, the better the steam-making properties will be.

In describing the new Atlantic type locomotive for the Baltimore & Ohio Railroad last month it was noted that this engine had more heating surface for its weight than any locomotive of which we had record. This brought up the necessity for a new basis of comparing locomotives. While the statement is literally true, the ratio between the total weight and heating surface of the engine is greater than in a number of other recent designs. If the assumption that power depends upon heating surface is fair, the use that is made of the weight should form the basis of comparison. If it is not fair, a strong tendency in locomotive design of the present time is wrong. The following table reveals the relation between the total weight and the heating surface of a number of notable locomotives by several of the most prominent builders, and it may be said to show how well the weight of such locomotives has been utilized to obtain the desired heating surface.



Midland Railway, England.

Name of Road.	Engine Number.	Total Weight.	Total Heating Surface.	Total Weight Divided by Heating Surface.
N. Y. Central	2,980	176,000	3,505	50.20
Lake Shore	650	174,500	3,343	52.18
C. & N. W.	1,015	160,000	3,015	53.06
L. V.	681	225,082	4,105	54.83
B. & O.	1,450	150,000	2,663	56.50
B., C., R. & N.	77	158,000	2,551	62.17
C., B. & Q.	1,591	159,000	2,500	63.60
Can. Pacific	209	159,000	2,401	66.00
Pennsylvania	820	159,000	2,401	66.00

Note.—All are passenger locomotives, except that of the Lehigh Valley.

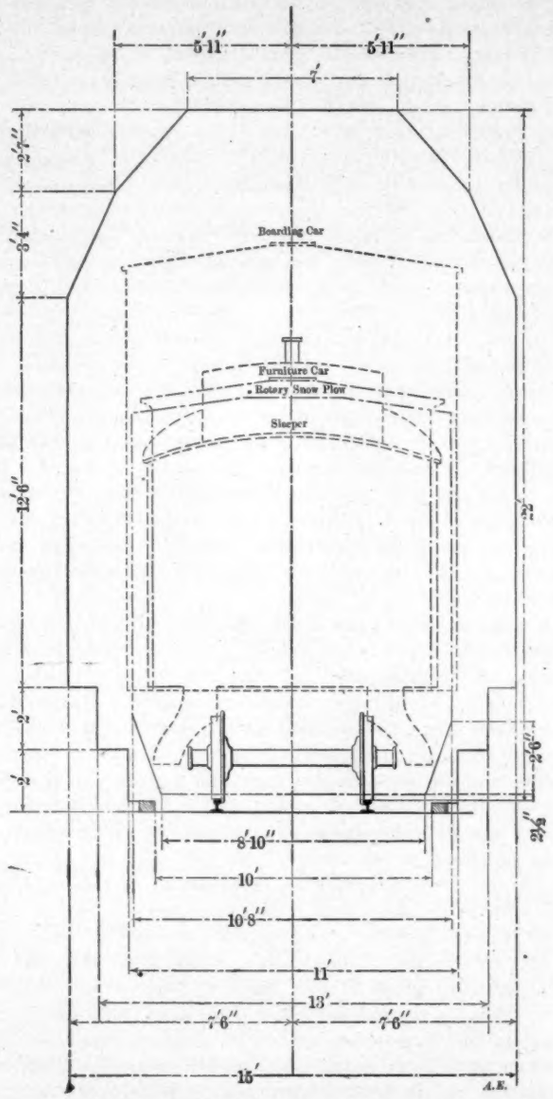
It may be said in the light of the practice of the past few years that this is the best way to compare the work of locomotive designers, and that it reveals the skill at the drafting-table stage of locomotive construction better than any other method.

When it is noted that of the two engines standing highest in this list one is an Atlantic type with outside bearings for the trailing wheels, involving heavy supplemental frames, and the other has six-coupled wheels, it will be understood that these figures represent a great deal of engineering skill. The Lake Shore engine referred to is the new "Class J," illustrated in this issue. It should be borne in mind that three pairs of drivers and two pairs of truck wheels involve more weight in the running gear than two pairs of drivers and three pairs of truck wheels. Such a low ratio as 52.18 in a six-coupled engine and 50.20 in an "Atlantic" type are surprising and commendable.

COMPARATIVE STRUCTURE GAUGES.

Great Northern Railway (United States) and Midland Railway, England.

The restrictions placed upon the builders of English locomotives, in consequence of the limitations caused by tunnels, bridges, platforms and buildings, is plainly evident from the accompanying engraving of the standard structure gauge of the Midland Railway of England, as compared with that of the Great Northern Railway of this country, which has one of the largest minimum cross-sections. With the two-cylinder compound locomotives of this country it is customary to flatten the cylinder casings of the low-pressure cylinders when the diameter approaches 3 ft., but with the mogul freight locomotives built recently by the Schenectady Locomotive Works for the Midland Railway, and pictured in our July, 1899, issue, it was necessary to flatten the castings of 18-in. cylinders. This shows the limitations necessarily placed on the width of English locomotives. The dotted lines in the engravings refer to the largest outside dimensions of the rolling stock of these two roads, and the solid lines the largest minimum fixed structures. Considerable difference is shown in the clearance distances, particularly in the height from rail to lowest point of fixed structures. This instance in the case of the Midland Railway is 14 ft., as against 22 ft. on the structure gauge of the Great Northern, showing that the English locomotive has about



Great Northern Railway, United States.

reached its limit both in height and width with the present conditions of the structure gauge, while the roads of this country have clearance space sufficient for considerable further development of the present locomotive.

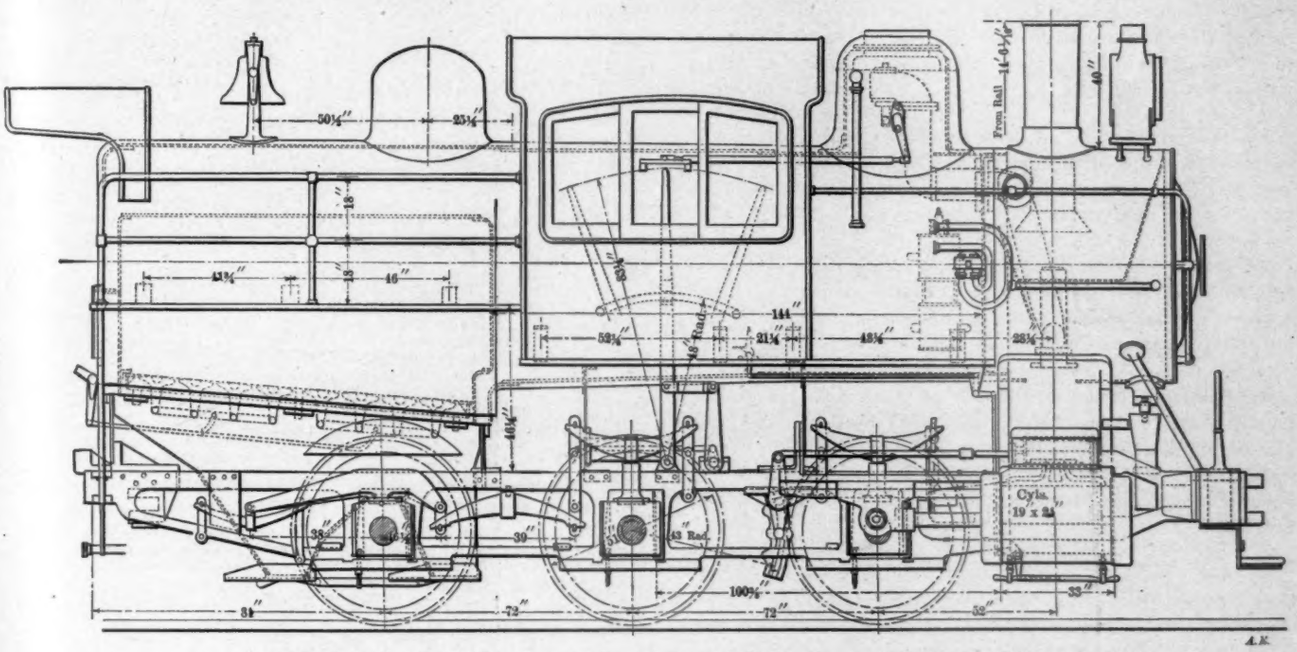
The accompanying engraving of the Midland structure gauge was prepared from a drawing received through the courtesy of Mr. S. W. Johnson, Chief Locomotive Superintendent of the Midland Railway. It should be stated here that the Great Northern diagram is an unusually large one, even for this country.

CULM-BURNING SWITCHING LOCOMOTIVES.

Delaware, Lackawanna & Western Railroad.

Mr. T. S. Lloyd, Superintendent of Motive Power of the Delaware, Lackawanna & Western Railroad, has designed new six-wheel switch engines for that road embodying his ideas as to grate area and heating surface required for culm-burning with a view of economical operation which he finds exceedingly important even with low-priced fuel. An order of 14 of these engines is now under way at the Dickson Locomotive Works, Scranton, Pa. A side elevation of the design is shown here. The proportions of the engines are given in the appended table.

Cylinders	19 by 24 ins.
Boiler, type	Radial stay straight top, wide firebox
Boiler, diameter at small ring	62 ins.
Boiler, thickness of sheets	9/16 ins.
Boiler pressure	180 lbs.
Fuel	Fine anthracite
Firebox, material	Steel
Firebox, length	102 ins.
Firebox, width	96 ins.
Firebox, depth	Front, 58¼ ins.; back, 49¾ ins.
Firebox, thickness of sheets	Sides and back, ⅝ in.; crown, ⅜ in.; tube sheets, 9/16 in.
Tubes	Number, 270; diameter, 2 ins.; length, 12 ft.
Heating surface, firebox	170 sq. ft.
Heating surface, tubes	1,709 sq. ft.
Heating surface, total	1,879 sq. ft.
Grate area	68 sq. ft.
Driving wheels, diameter outside	51 ins.
Driving wheels, diameter centers	44 ins.
Driving axle journals	8 by 11 ins.
Wheel base, driving	12 ft.
Wheel base, rigid	12 ft.
Wheel base, engine and tender	36 ft.
Tender wheels, diameter	33 ins.
Tender journals, diameter and length	4¼ by 8 ins.
Tender, tank capacity	3,300 gals.



Culm-Burning Switching Locomotive—Delaware, Lackawanna & Western Railroad.

T. S. LLOYD, *Superintendent Motive Power.* DICKSON LOCOMOTIVE WORKS, *Builders.*

Special care was taken to secure uniformity of loading upon the driving wheels, the object being to obtain exactly 39,333 lbs. upon each wheel or a total of 118,000 lbs. The wide variation of weight among the wheels of a number of recent locomotives was considered objectionable. The firebox has easy curves and no straight portions and special attention was given to the boiler bracing, to distribute the stresses in order to avoid recent difficulties with the deformation of outside sheets due to concentration of the stresses of the bracing. The frames are heavy, and in all particulars the design was carried out as carefully as in a road engine, which is somewhat unusual for locomotives for yard service. In the cab the same thought was applied in order to place every device used by the engineer within easy reach. This is generally receiving more attention than formerly.

General dimensions:

Weight on drivers, working order	118,000 lbs.
Weight of engine, total	118,000 lbs.
Weight, total of engine and tender	189,000 lbs.

With a conscientious persistency characteristic of the man, Mr. G. W. Rhodes is conducting a vigorous agitation looking to a proper maintenance of air-brake apparatus. He does not mince matters in the least, but in a very quiet and forcible way shows the absolute necessity for keeping air brakes in good condition. The January meeting of the Central Railway Club was devoted to this subject, the impression given being that for some reason, probably oversight, this apparatus is all but universally neglected and even the easy requirements of the M. C. B. Association as to cleaning triples once a year is not observed. That a triple valve will work at all when neglected for five years is strong evidence of good apparatus, but there is a penalty for such neglect. In the discussion referred to, Mr. Quereau told of a runaway train on a 3 per cent. mountain grade 5 miles long, the speed of which caused the engine to break 24 85-lb. steel rails in 27 places. This was due to defective maintenance of the brake apparatus. No other damage was done, but is it necessary to wait for a tragedy to awaken interest in such a question?

Plans have been prepared for a new $2,000,000 station in Chicago for the Lake Shore and Rock Island roads, to be built on the site of the present structure. The new station will occupy the entire space between Pacific Avenue and Sherman Street, with a frontage about 30 ft. greater than that of the existing building. The waiting room is to be on the level of the elevated tracks of the Union Loop.

PERSONALS.

Mr. T. F. Brady has been appointed Master Mechanic of the Mexican Central at Chihuahua, Mexico, in place of Mr. H. W. Ridgway, resigned.

Mr. L. Larrieu has been appointed Master Car Builder of the Chicago, Rock Island & Pacific Railway, in the place of Mr. J. Randell, resigned.

Mr. H. C. Pearce is appointed Purchasing Agent of the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Minneapolis, Minn., vice Mr. J. E. Shaughnessy, resigned.

Mr. C. W. Lee, Foreman of Locomotive Repairs of the Southern Railway at Greensboro, N. C., has been appointed Master Mechanic of the Seaboard Air Line at Raleigh, N. C.

Mr. J. Ogden Armour was at a recent meeting of the directors of the Chicago, Milwaukee & St. Paul elected a director, to fill the vacancy caused by the death of his father Philip D. Armour.

Mr. Harry Bennett has been appointed Master Mechanic of the Juniata shops of the Pennsylvania, at Altoona, Pa., to succeed Mr. T. R. Browne, resigned to become Works Manager of the Westinghouse Air Brake Company.

Mr. Edward Mahler, formerly Purchasing Agent of the New England and later in the service of the New York, New Haven & Hartford, has been appointed Purchasing Agent of the Boston Elevated in place of the late John Sever Tebbets.

Mr. Palmer C. Ricketts, Director of the Rensselaer Polytechnic Institute of Troy, N. Y., has been elected President and Trustee of that institution to succeed the Hon. J. H. Peck, resigned. Mr. Ricketts is a distinguished practical engineer and has for many years been a frequent contributor to scientific literature.

Mr. J. E. Muhlfeld, Master Mechanic of the Grand Trunk at Fort Gratiot, Mich., has been appointed Master Mechanic in charge of the locomotive shops at Montreal, Que., vice Mr. A. G. Elvin. Mr. J. McGrath has been appointed Master Mechanic in charge of the Fort Gratiot shops with headquarters at Fort Gratiot, Mich.

Mr. W. O. Thompson, Traveling Engineer of the Toledo division of the Toledo, St. Louis & Western, has been appointed Master Mechanic with office at Delphos, O., and Mr. Edward Elden, formerly with the Lake Shore & Michigan Southern, at Buffalo, becomes Master Mechanic of the St. Louis division, with office at Charleston, Ill.

The Purchasing Department of the Lake Erie & Western will be transferred about March 1st from Indianapolis, Ind., to Cleveland, O. Mr. W. F. Goltra, who has been in charge at Indianapolis, will go to Cleveland as Chief Clerk to Mr. F. H. Greene, who is Purchasing Agent of both the Lake Erie & Western and Lake Shore & Michigan Southern.

Mr. Edwin G. Russell who was, until September 1st, 1901, General Superintendent of the Delaware, Lackawanna & Western, Scranton, Pa., has been appointed Manager of the Intercolonial Railway, with headquarters at Moncton, N. B., in place of Mr. David Pottinger, who is to be Chairman of the new railway association to be created by Parliament.

Mr. Roger Atkinson, Superintendent of Rolling Stock of the Canadian Pacific, has resigned, after 19 years' service with that company. Of those 19 years, he spent 8 years as Chief Draftsman, 3 years as General Foreman, 2 years as Acting Mechanical Superintendent and 5 years as Mechanical Superintendent. He was appointed Superintendent of Rolling Stock in April of last year.

M. M. Martin, for 17 years Superintendent of the Car Department of the Wabash, died at his home in Litchfield, Ill., February 12th, aged 69 years. Born at Sussex, England, on May 31, 1831, he came to this country when quite young, and at the age of 20 years entered railway service with the old Michigan Southern & Northern Indiana, at Adrian, Mich., as foreman. After serving 7 years in this capacity he was made Master Car Builder of the St. Louis, Alton & Terre Haute, which position he filled for 7 years. He also served 7 years as Master Car Builder of the Ohio & Mississippi; 1 year as Superintendent of the Indianapolis Junction; 2 years as Superintendent of the Litchfield Car Works at Lichfield, Ill.; 2 years as Master Car Builder of the Southern lines of the Illinois Central and 4 as Vice-President of the Litchfield Car & Machine Company. The last position he left in 1884 to become Superintendent of the Car Department of the Wabash.

William C. Baker, originator of the famous Baker heater, was killed on Feb. 6 by a train on the tracks of the Erie Railroad, near Montclair, N. J. Mr. Baker is best known in railroad circles by his connection with the Baker Heating Company, and his work in the matter of heating cars. During his career he had taken out something like 43 patents, of which his system of heating passenger cars by the use of steam from the locomotive, a safety explosive vent and the Baker heater, are the best known and most extensively used, both in this country and abroad. Mr. Baker was born in Dexter, Me., July 25, 1828, where he spent the early part of his life. He came to New York about 50 years ago and was the founder of the firm of Baker, Smith & Co., and later a promoter of the New York Steam Heating Company. At the time of his death he was carrying on business in his own name as successor to the Baker Heater Company. Mr. Baker is mourned by two daughters, one living at Montclair, at whose home he has been spending the winter. In all railroad circles he was known as energetic and very enterprising, and his work will not soon be forgotten by the traveling public.

During a recent trial test of the ice breaking steamship "Ermack," to penetrate ice in the Arctic Ocean, the vessel was struck in a comparatively weak underpart of her hull by a low-lying block of ice, which caused a leak. This accident occurred after she had steamed north from the northwest of Spitzbergen, breaking through fields of ice 13½ to 15½ ft. in thickness with comparative ease. It was not until several accumulations of ice 49 ft. thick and over 20 ft. high from the surface of the sea had been encountered and broken that she was disabled and compelled to return to her dock at Newcastle. The "Ermack" has a displacement of 8,000 tons and 10,000 h. p. Of the total horse-power, 2,500 is developed by the forward engine and used to drive a forward screw. This screw was found to be useless in the polar seas, so that the forward engine was not used, sufficient power being developed with the remaining engines, while running with moderate steam, to break through the hardest ice in that region. The conclusions from these tests are that an ice-breaking steamship in the Arctic Ocean must not only be strengthened in her front part down to the water line, but the whole extent below the water, and that the forward screw cannot be used in the polar seas.

A sentence of 11 years in the State prison at Thomaston, Maine, has just been imposed upon George White, of Wells, in that State, for throwing a stone through a car window and tampering with a switch. Such dangerous acts should be stopped and the report of the severe sentence should be brought to the notice of those likely to be tempted to commit them.

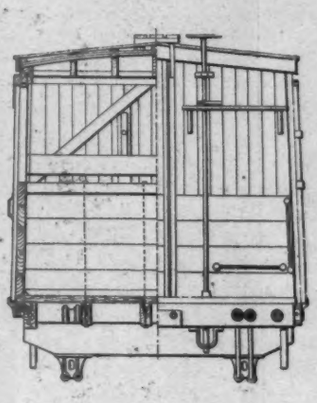
THE "HANDY" COMBINATION BOX AND GONDOLA CAR.

To reduce the proportion of empty to loaded car mileage is the object of a number of designs of cars with a view of rendering them convenient for various kinds of special traffic. The design known as the "Handy" car, which is controlled by Mr. C. L. Sullivan, was designed to serve both as a box and a gondola car. It has the usual large side doors and four additional doors through which the lading may be conveniently handled.

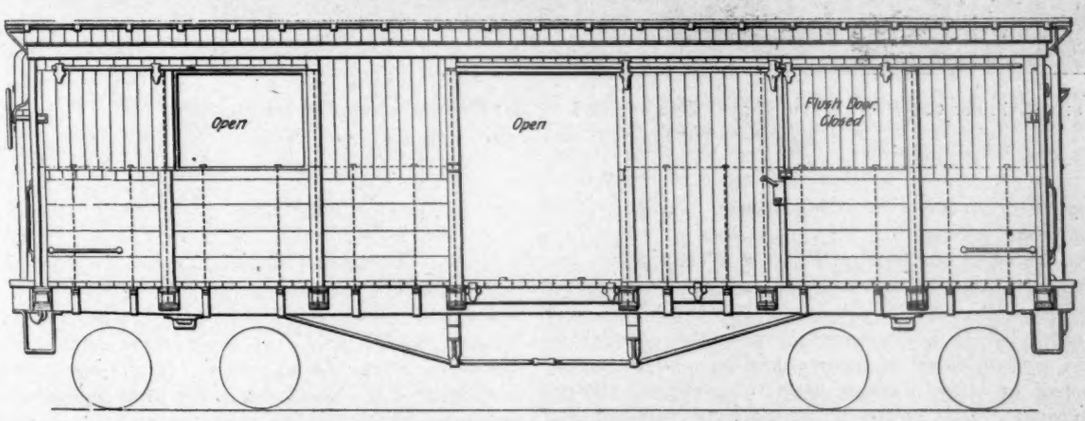
The novel features are in the construction of the sides and ends. The roof construction above the carlines may be of any desired form, and the same applies to the construction from the floor to the rails. Stake pockets are used to receive the ends of the posts, and the ends of the carlines are secured to the plates by malleable brackets. Angles or tees are used for the corner posts and also end, side and door posts. The siding from the belt rail down is in short lengths of 2¼-in. boards cut in panels to fit between the steel posts; and in order to form a slot to receive the ends of the boards, a flat plate is secured to the flanges of the angles forming the posts. Strap bolts similar to those used in gondola cars extend from the belt rail through the ends of the floor planks and through brackets secured to the side sills. The end boards are in one piece across the car. The usual inside sheathing is omitted, and the car is flush on the inside from the belt rail down; but the outside sheathing extends from the belt rail to the top of the plate in the usual manner. In this construction vertical tie rods and angle braces are unnecessary and are omitted.

There is nothing unusual about the middle doors, and any form of grain door may be employed. The auxiliary doors are made to close flush with the siding and are automatically locked on the inside, rendering seals unnecessary.

A claim for superior strength for this construction as compared with an ordinary box car is based upon the use of the steel posts. A largely increased internal capacity for loading is obtained by reducing the thickness of the walls from the usual 4 or 5 ins. to 2¼ or 2½ ins., and in addition to this the sides of the car are battered. Tunnel clearances determine the width of the roof, but instead of running the sides down vertically, the usual way in box-car construction, the sides are battered outward, making the floor from 4 to 6 ins. wider than usual. It is claimed that to secure as great volume for loading in an ordinary box car the cost would be greater than in this design; also that the use of short lengths of lumber reduces the cost $4 or $5 per thousand feet. The cost of the steel posts is believed to be less than that of wood for these parts. The accompanying engraving shows a photograph of a car taken after 14 months of hard service and no repairs of any kind were required, though the car was used on one of the leading trunk lines. This construction is protected by United States and foreign patents. Mr. Sullivan will be glad to furnish additional information; his address is 1425 Old Colony Building, Chicago.



The "Handy" Combination Box and Gondola Car.

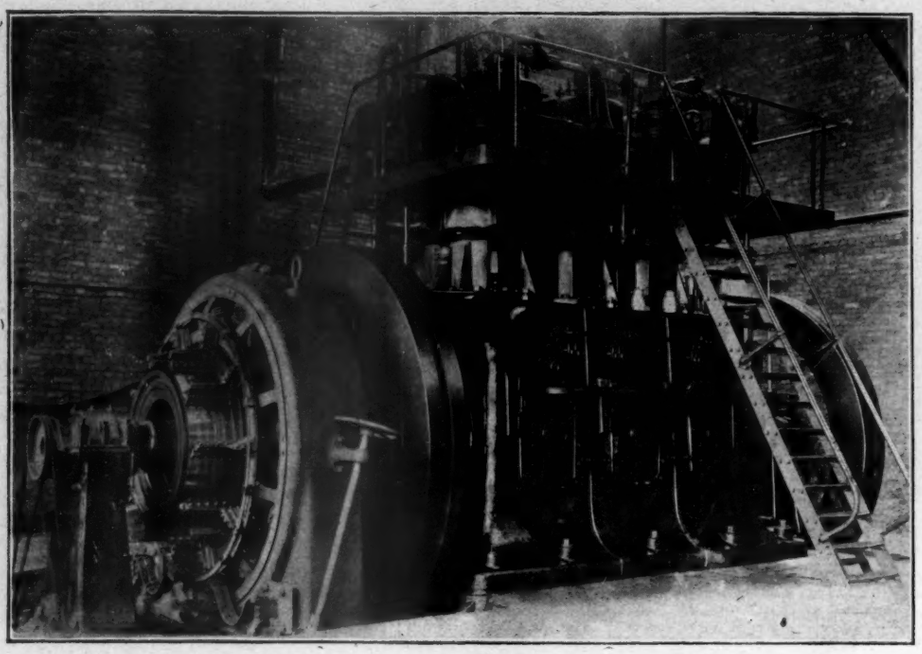


The "Handy" Combination Box and Gondola Car.

A LARGE GAS ENGINE IN IMPORTANT SERVICE.

When fairly started in this country the gas engine will make rapid progress, but as yet we are far behind foreigners in appreciating it. The gas engine is not yet perfect, but there seems to be no reason for delaying longer to accept it as a reliable substitute for the steam engine. The gas producer has had a parallel development with the gas engine in other countries and we may expect equally good results here.

The leaders in the construction of large gas engines are the manufacturers of the Westinghouse engines. These are now made in sizes up to 1,500 h. p. They are in use for operating electric light and power apparatus in manufactories, and for driving electric street railway generators, and in general power service.



Three-Cylinder 650 H.-P. Westinghouse Gas Engine Driving a Direct-Current Generator. Howard Axle Works, Homestead, Pa.

We show herewith an illustration of a Westinghouse gas engine which is now in operation at one of the Carnegie company's properties at Homestead. It is of 650 h. p., and is direct-connected to a direct-current generator, furnishing power to a large number of motors used for driving lathes and a variety of other machine tools; also electric cranes, furnace blowers, etc. Power is furthermore supplied for arc and incandescent lamps. This engine runs night and day without intermission for considerable periods, runs of 260 hours under load having been made thus far, while undoubtedly far longer runs are entirely feasible if the work demands them.

The engine is of the three-cylinder type and three ignitions occur in every two revolutions. This frequency, with a flywheel keyed upon each end of the shaft, suffices to give a speed regulation so close that the voltage of the direct-connected generator is maintained at a fixed point with precisely the same certainty that marks the best steam engine. The engine at Homestead is supplied with gas from the mains of the Carnegie company, so that there is no apparatus installed in connection with this power service which in any way corresponds to the boiler plant necessitated by the steam engine installation. The floor space given over to the production of 650 h. p., and its conversion into electric power measures only 29 by 11 ft., excepting the small areas occupied by the switchboard and the compressed air apparatus used to start the large engine.

Instead of omitting an occasional charge of the gas and air mixture, the speed regulator, a two-ball centrifugal governor, resembling those in general use, causes the admission ports of the cylinder to be kept open for longer or shorter periods of time, thus admitting more or less of the gaseous mixture according to the demands of the loads. This is precisely analogous to steam engine practice and is claimed to produce equally good regulation. Regulation of speed, especially in the operation of electric machinery, is of first importance, and upon the attainment of this feature the success of the perfected gas engine rests.

Of vital importance also is the question of thermal efficiency, and in this regard the gas engine easily leads. Some recent tests of this type of engine in actual use show an efficiency of over 25 per cent., one horse-power-hour having been obtained repeatedly on a consumption of gas that represented only 10,000 thermal units. As this is practically twice the efficiency of the average high-grade modern steam engine, the advantage possessed in this respect by the gas engine is seen to be an important one.

In a rapidly increasing number of cases producer and furnace gases are becoming available for gas engine work. So great, indeed, is the efficiency of the gas engine and so little attention does it require that in many cases where only the relatively expensive illuminating gas is available gas engines of smaller sizes are operated by this means at surprisingly low running costs.

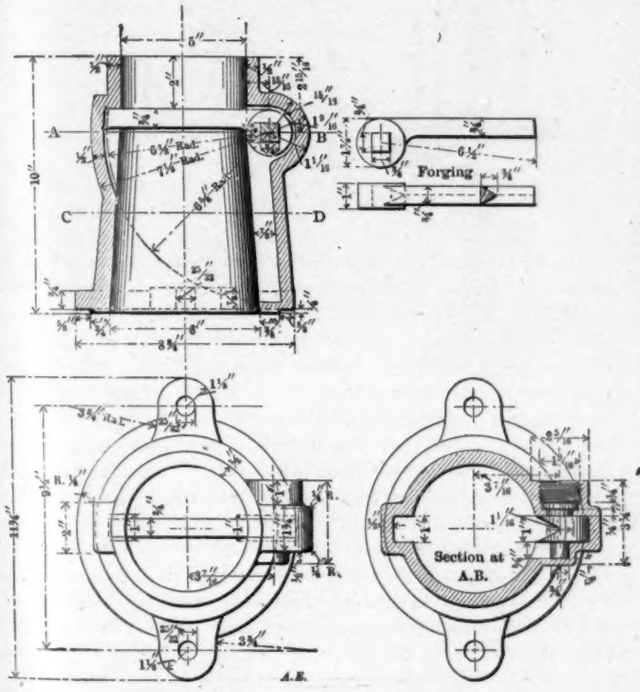
Recent tests of the Diesel oil engine described in "Engineering" showed a thermal efficiency of 30.7 per cent. This is remarkable in view of the fact that the best steam engines of about 1,000 h. p. give only 15 or 16 per cent. The mechanical efficiency of the Diesel engine was, however, low, about 30 per cent. of the power being required to operate the special air pump to give the necessary pressure of about 800 lbs. per square inch. The initial cylinder pressures were about 500 lbs. per square inch. Such high pressures obviously require the best of material and fine workmanship and all joints, including the piston packing, must be tight.

Strong endorsement was given to the practice of burnishing journals of car axles in a recent discussion before the Northwest Railway Club. Mr. Roope, of the Great Northern Railway, said: "I do not see how we can expect to get good results from axles, the journals of which have not been rolled, unless we put them in a slow train and endeavor to break them in. When a journal on a new axle is rolled and an old journal is placed alongside it, with a strong glass you cannot tell which is the old and which the new one." He also spoke of a lot of hot boxes on a car, developed before the car had gone 50 miles. Investigation showed that the journals had not been rolled. On that road a high place is given to this simple and inexpensive precaution. Why is it not a good plan for general adoption?

VARIABLE EXHAUST NOZZLE FOR LOCOMOTIVES.

Plant System.

To do away with much of the unnecessary work on the front end of locomotives, in the matter of bridging and bushing nozzle tips, Mr. Symons, Superintendent of Motive Power of the Plant System of Railways, has devised a variable exhaust nozzle, the accompanying engraving of which was prepared from drawings received through the courtesy of Mr. Symons. While no specific claims for economy are made for this device, he believes it is quite a factor in the saving of fuel and eliminating boiler repairs, both in the firebox and front end. The nozzle, which is shown in vertical section, is similar to the ordinary single-tip nozzle, with bosses on each side of the nozzle to allow the V-shaped bridge ¾ x ¾ in., which is shown in a horizontal position in this view, to swing vertically downward. When in the latter position, this bar or bridge fits into a ⅞ x 1-in. triangular groove in the side of the nozzle made to receive it. The section at A B shows



Variable Exhaust Nozzle.

the bosses cored out to admit the bridge, which is pivoted at one end on a 1 1/16-in. pin, long enough to pass through the smoke arch. This bridge is free at the other end to swing up to a horizontal position against a shoulder in the casting, or it may be turned down out of the way. This appliance is rigged with a 10-in. lever, which fits on the free end of the pin, which passes through the bridge to the outside of the smoke arch. A reach rod connecting to the lever passes through the cab to a position convenient for the engineer. Notches are made on the reach rod so as to lock the bridge in the desired position. It is obvious that the pulling power of a locomotive can be increased by reducing the back pressure to a minimum when certain conditions are favorable to use the maximum size of opening. Cards taken from a ten-wheel passenger engine built by the Richmond Locomotive Works for the Plant System, over a year ago, and equipped with the nozzle, show a difference of from 60 to 100 indicated horse-power between the open and the closed nozzle. The device is not an expensize one to make and could be easily applied to any single-tip nozzle.

GOOD USE OF THE TECHNICAL PAPERS.

The practice of the Schenectady Locomotive Works concerning the technical periodical literature should be widely noted and copied. It is the duty of one of the clerks to insert a printed slip between the pages of every paper regularly received at the works and start it on its course among the officers. The slip contains the following:

Schenectady Locomotive Works.

In order to permit as many as possible to look over such current periodicals as are received by the company as soon as possible after publication, you will kindly see that this journal is forwarded from your office within two days of its receipt as directed below:

Forwarded by.	To.	Date received.	Date forwarded.
(The officers' names are printed here.)	(Names here.)	.....	.....

It will be filed in the correspondence room when returned and may be referred to at any time desired.

When returned to the correspondence room the various articles upon locomotive subjects are carefully indexed in a card catalogue which is kept up to date and available for reference. The papers are bound and kept in the library.

Mr. R. H. Soule introduced a somewhat similar plan on the Norfolk & Western. He kept the files of papers in his office, but, before filing them, various articles were marked and the subjects assigned to different subordinates for examination and report, with a view of ascertaining the value to that road of the suggestions contained in the practice of other roads. The articles were then indexed and the papers bound at the end of the year.

It should not be forgotten that these periodicals are prepared by men who spend all their time watching progress with a view of presenting new ideas or new applications of old ones. It is worth while to suggest the advisability of appointing to a draftsman, or other subordinate, the duty of studying the current railroad literature with a view of guarding against the escape of an idea that might profitably be applied but is now passed unnoticed because it is no one's special business to attend to it. This is one way in which the drafting room might be made more helpful.

The M. C. B. committee on triple valves have recently completed tests of a new form of triple submitted by Mr. R. Fitzgerald, General Superintendent, Chicago Junction Railway. The tests were made upon the association rack in the laboratory of Purdue University. They were conducted by Messrs. G. W. Rhodes, W. S. Morris and William McIntosh, representing the M. C. B. committee. The committee was assisted by Mr. A. J. Cota, Air Brake Instructor of the Burlington system; Mr. W. P. Huntley, Jr., Air Brake Instructor of the C. & O. R. R., and also by members of the instructional corps and by students of Purdue University. The owner of the valves was represented by Messrs. Harvey S. Park and M. W. Hibbard.

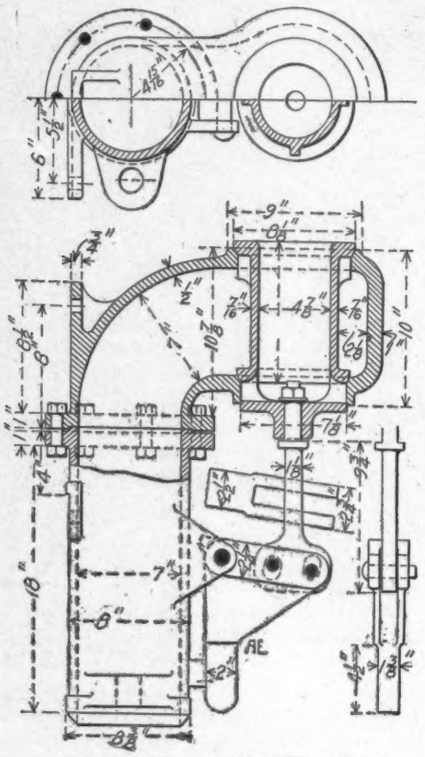
Hydraulic tools have made an important place for themselves in various branches of railroad work in the shop, on construction work and in wrecking. They, particularly hydraulic jacks, are indispensable, and it is surprising to find in a recent discussion before the Western Railway Club that these tools are considered unreliable. An implement of this kind needs care, and the character of the questions raised on the occasion referred to indicated a lack of knowledge as to even the composition of the liquid used in the jacks. They should be filled with one part of pure grain alcohol diluted with two parts of water, and then if the packing leathers are changed often enough the hydraulic jack will work. At least this is the judgment of those who take care of such tools.

THROTTLE VALVE TAKING STEAM FROM THE TOP OF THE DOME.

Baldwin Locomotive Works.

The throttle valve illustrated by this engraving was designed with a view of taking steam from the top of the dome only, thus preventing the admission of wet steam to the dry pipe, which must necessarily occur at times with the ordinary throttle taking steam from both top and bottom of the valve. It is believed that the difference of 10 ins. in height, which is the height of the valve in this case, will have a marked effect upon the dryness of the steam.

The drawing shows the construction very clearly. The opening in the dry pipe under the valve is closed by a close-fitting



Improved Locomotive Throttle.
Baldwin Locomotive Works.

circular plate, and, by making the valve hollow, steam may enter the pipe under both the flanges of the valve, but it must all come from the space in the dome above the valve.

The engraving also shows the double pin leverage of the bell crank which operates the throttle. During the first part of the movement of opening, the bearing of the valve is upon the inner pin. This gives a greater leverage and slower motion to the valve than it has during the remainder of its motion when the outer pin takes the weight of the valve. This feature, however, is not new.

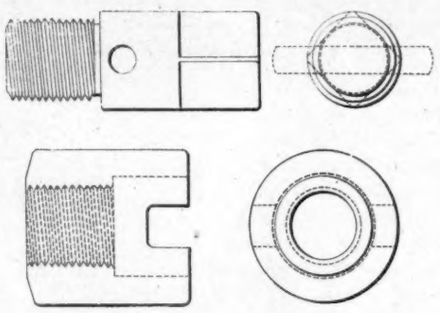
We are indebted to the Baldwin Locomotive Works for the drawing of this improved throttle, which was the subject of a patent by Mr. K. Rushton.

At the February meeting of the New York Railroad Club Mr. Willard C. Tyler read an elaborate and instructive paper upon Japan, with particular reference to the transportation facilities and national characteristics, presenting a large amount of information which has not before been put into print. The speaker spent two winters in Japan and described conditions which travelers seldom see. Mr. Tyler is a close observer and his account of the country was intensely interesting. The proceedings of the club will contain the paper in full.

A "STUD NUT" FOR SCREWING IN STAY BOLTS.

The Master Mechanics' Association last year discussed methods for screwing stay bolts into locomotive boilers, and in connection with the forms of staybolts means for turning them in without squaring the ends for wrenches were mentioned. In the discussion Mr. T. R. Browne, then of the Pennsylvania, described a simple device which he was using with good results. It is illustrated by means of the accompanying engraving, made from a sketch, and the following description is taken from the published report of the convention:

"We round off the end of the bolt to a radius which we have found to be satisfactory, and which, with the least amount of hammering on the end, will properly cause it to fill up the threads in the sheet. For the purpose of screwing in these bolts, which we do, either from the inside or outside, according



A "Stud Nut" for Staybolts.

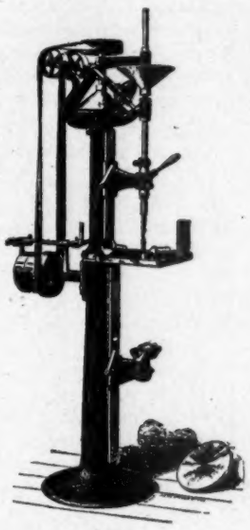
to the angle at which they are with reference to the sheet, we have what might be called a stud nut, consisting of a sleeve tapped out in one end to suit the bolt and beveled off so as to clear the angle that the sheet forms with reference to the bolt, and in this sleeve is a plug with a square end. Through the plug and the sleeve is a tapered pin fitting a hole in the plug, and which also fits a slot in the sleeve. It is obvious that you can screw it tightly on the end of the bolt, taking up enough threads to hold, and when you unscrew it the plug will back away, leaving the sleeve stationary until the pin is brought up against the slot in the sleeve. Then the whole device can be unscrewed from the end of the bolt and used on the next bolt. Where the angle of the bolt with reference to the sheet is very great, frequently there is no thread on one side to get hold of the bolt. In cases of that kind we screw it in from the inside of the boiler."

A number of important appointments have recently been made on the faculty of the Massachusetts Institute of Technology, no less than ten instructors having been promoted to the rank of assistant professors. In the chemical department, Dr. Henry Fay becomes Assistant Professor of Analytical Chemistry and Metallography; Dr. Jas. F. Norris, Assistant Professor of Organic Chemistry; Dr. F. H. Thorp, Assistant Professor of Industrial Chemistry, and Dr. W. R. Whitney, Assistant Professor of Theoretical Chemistry and Proximate Analysis. In the department of physics, Messrs. L. Derr, C. L. Norton and Dr. G. V. Wendell were promoted Assistant Professors. The list of promotions in the department of mechanical engineering includes three Institute graduates of the class of '92—Messrs. Charles E. Fuller, William A. Johnston and Charles F. Park. All three have been connected with the Institute continuously since their graduation in work of increasing responsibility. Each of them has given instruction in drawing and in mechanical engineering laboratory work, while Messrs. Johnston and Park have also conducted classes in mechanism. Mr. Fuller and Mr. Johnston are now conducting classes in applied mechanics in addition to aiding Professor Miller in the conduct of the laboratory; Mr. Park has charge of the mechanical engineering drawing-room and is also conducting a class in mechanism.

FRICTION SENSITIVE DRILL PRESS.

Manufactured by the Knecht Bros. Company, Cincinnati, O.

There is hardly a machine in the metal working line where the speed of the working tool changes in shorter intervals than in a sensitive drill press. It is, therefore, of great importance for time and tool saving to have the speed-controlling medium instantaneous and precise. These features are embodied in the Knecht friction sensitive drill. From the accompanying engraving of this press it will be seen that the driving mechanism consists of two cones between which is held the friction roller. The power is transmitted from the lower cone to the friction roller which transfers power to the upper or spindle cone. The roller is adjusted radially with the cones. The speed of the drill spindle is increased or diminished instantly without stopping the machine, shifting belts or without the operator changing his position; by simply sliding the friction roller frame upon which is mounted the friction roller, up and down on the cones. From one extreme to the other, a distance of only 4½ ins., any imaginable number of speeds can be obtained for any size drill, from the smallest up to and including 9/16 in. More or less driving power to the drill spindle is applied as the size of the drill or the nature of the work may require. In many of the sensitive drill presses, frequent breakage of small twist drills is an annoying occurrence, while in this machine this difficulty is overcome. Power applied can be graduated to drive with equal safety the smallest or largest drills within its range, being a wonderful economy in time and a great saving in drill breakage. The cone that drives the spindle is mounted on a sleeve or bushing which extends through both bearings in the frame, the spindle being relieved thereby from any lateral pressure which enables the machine, when properly oiled, to run any length of time without heating. This spindle sleeve or bushing has thrust bearings. The bar on which the friction roller frame slides is marked with the size of drills within the range of the machine, so that the operator can get the proper speed for any drill without loss of time by simply placing the end of the roller frame at the figures on the bar corresponding to the size of the drill to be used and holding it in position by a clamping screw. This is a necessary improvement, as it allows the operation of the machine and the manipulation of the work to the best advantage in running twist drills at just the proper speed, not too high to burn them, nor too low, which would cut down the rate of production. This press is the result of many years' experience with tools of its class, and has been designed to meet all the requirements of a sensitive drill for tool-room service and all classes of light, sensitive, rapid and accurate drilling, embodying many new and original improvements that place it in the front rank as a drill of modern and perfect design, making it simple in construction and very effective in operation for light and rapid work. This drill press is a high-grade machine tool in all respects, and has proved very satisfactory to those who have it in use. Mr. A. H. Thompson, Manager "Canadian Motors," says: "The Knecht friction sensitive drill purchased some time ago is giving entire satisfaction. It does its work beautifully, in fact, we cannot speak too highly of it." Those who are interested in drill presses should write to the Knecht Brothers Company, manufacturers of machinery and tools, Beekman street, Cincinnati, O., for circular No. 4 giving a complete description.



Friction Sensitive Drill.

COMBINATION TRIANGLES FOR DRAFTSMEN.

Manufactured by D. J. Kelsey, New Haven, Conn.

Mechanical draftsmen and engineering students generally will be glad to know of Mr. D. J. Kelsey's improved combination triangles, which are a means of great convenience and much time saving. The triangles are made of transparent celluloid in sizes ranging from 4 to 10 ins. They are held by a knob and well balanced, serving all angles without being reversed. They are given a slightly concave form toward the drawings, which prevents the celluloid from being scratched and also preserves the drawings. On the under surface of the larger sizes, protractors are cut, rendering the close contact of the protractor with the work very convenient for measuring or laying off angles. In the body of the triangle erasing stencils are provided, with a long, narrow slot at the bottom having thin edges. The slot is recessed so as to guide the rubber and prevent rapid wear of the slot. A simple celluloid frame is provided for these triangles whereby they may be clamped in any position, rendering the instrument an especially handy one for drawing the details and connections of lever machinery, bolt heads, screw threads, coiled springs, the teeth of worms and racks, tapers on hubs and bosses, die blocks and angle work generally. The frame has a metal edge which rests against the T-square. On the triangle alone depends its accuracy, as the frame resting against the T-square is brought up to position and clamped to the triangle, after the triangle has been set to the required angle. The parallel ruler or slipping triangles are entirely superseded by this device, which has the added advantage that it carries ruling edges for lines and their perpendiculars on any part of the drawing-board at one setting. The expense of these triangles is very small when one considers the ease and rapidity with which one is able to perform angle work, as it practically serves the place of more elaborate and expensive metal instruments with the greater advantage that it is all in one piece and not scattered over the drawing table in many pieces. An illustrated pamphlet of these instruments will be sent to draftsmen, or those who are particularly interested in draftsmen's specialties, upon application to D. J. Kelsey, 85 Cottage Street, New Haven, Conn.

REVERSING TAP HOLDER.

The accompanying engraving shows a reversing tap holder manufactured by the Ideal Machine Works, Hartford, Conn. This tool is simple and complete in itself, requiring neither a reversing belt nor special connection of any kind with the machine. It is a valuable factor in preventing the breakage of taps and will handle all sizes of machine taps up to 7/16 in.

This tap-holder is attached to the spindle of a lathe or drill press with the ease and manner of the ordinary drill chuck. From the engraving it will be seen that around the body of the holder fits a loose running sleeve on the inside of which it cut an internal gear. This gear finally operates a spindle by means of two intermediate gears. The spindle extends down through the body of the holder and is so constructed at the lower end as to accommodate the various sizes of taps. The whole device is held to the machine by a driving shank which fits into a tapered hole in the top of the holder. The operation of the tool is very simple. Before it is forced up to the work or the work against the tool, the spindle is given a slight vertical movement by turning the sleeve. The two pins in the socket arrangement for receiving the taps, catch upon the two driving pins of the upper part of the holder, and feeds the tool into the work until the spindle or work holder, as the case may be, comes to a stop that has been set to regulate the depth of the work. To stop the tap the pins are

drawn off far enough to cease contact, and by a tight grip of the revolving sleeve the tap is given a reversed motion, at a speed twice as great as the forward cutting speed. These tools are much used by bicycle and typewriter manufacturers and are found to be of particular value for use in all machine shops on multiple spindle or turret drills, where work is drilled and tapped at one handling.

POROUS EMERY WHEELS.

Manufactured by the Vitrified Wheel Co., Westfield, Mass.

A composition of emery, with another cutting material for a flux, is used in this product. It is molded into any desired form such as wheels, slabs, rings, etc., and subjected to an intense heat which vitrifies the mass, giving the particles of emery and corundum a high holding power. By this process no material is used that would tend to glaze the surface of the wheel and destroy the cutting action, but the particles as they wear away, leave the wheel. Such porous wheels may be said to be self-sharpening and cut as freely when nearly used up as when first put into use. The porosity of these wheels make them best adapted to tool cutting. It is claimed that there is no disagreeable odor or dust from their use and they run equally well wet or dry. If obliged to run in oil or acid they are not injured in the least. The cutting action is rapid, and as every particle in the mixture has a cutting quality, their usefulness is prolonged. When the proper grades are selected they do not heat or burn the work. A number of different grades of wheels should be kept on hand, suitable for doing each kind of work, so that a wheel need only be used for the purpose intended, as in some cases using a wheel for a kind of work for which it is not adopted will spoil the wheel for the work that should properly be done on it, as in the case of grinding rough castings on a wheel intended for fine tools. In selecting emery wheels too much stress cannot be laid on the importance of speed at which they are to run and the particular kind of work to be ground, as a wheel might be ordered for grinding steel and unless it was specified that it was to be used for grinding either cast steel, Mushet steel, tool steel or spring steel, the wheel would be found unsuited for the work. As to speed, a wheel might be perfectly adapted for that particular kind of work, and if run at too high a speed would glaze and fill up; on the other hand it may be run so slow that the wheel would be worn away very rapidly and not give good results. If the peripheral speed be kept at about 5,500 ft. per minute the best results will be obtained. This company also manufacture wheels containing a wire web in the center. They are made by the silicate process, as the webbing used would not stand the intense heat to which the vitrified wheels are subjected. These wheels are only made when ordered specially by customers. The vitrified emery and corundum wheels are made into many standard shapes and sizes, but any other desired shapes can be had without extra charge, on receipt of drawings showing what is wanted. The Vitrified Wheel Company's catalogue gives many of the more common shapes, together with tables of sizes and prices. This illustrated catalogue is now ready for distribution.

The American Railway Engineering and Maintenance of Way Association will hold its second annual convention in Chicago March 12, 13 and 14.

Mr. W. O. Jacquette, formerly Comptroller of the Pressed Steel Car Company, with office in New York, has been appointed District Manager, with headquarters in Chicago.

Mr. Sidney A. Stephens, for many years traveling representative of the Rhode Island Locomotive Works, has been appointed agent of the Brooks Locomotive Works for the Dominion of Canada, with offices at 22 St. John Street, Montreal.

BOOKS AND PAMPHLETS.

Questions and Answers From the American Machinist. Compiled by Frank Richards. Bound in cloth, 12mo., 403 pages. Published by the American Machinist. New York, 1900. Price, $1.50.

More than 10,000 questions have been asked by the readers of the "American Machinist" and publicly answered in the columns of that paper. Of these questions and answers, 1,088 of the more important ones of general interest and application have been put into book form. The range of topics is naturally wide and no attempt has been made at indexing farther than to divide the topics into 21 departments, such as steam boilers, steam engines, pumps, pattern-making, railroad and locomotive power transmission, etc. The criticism to be made of this volume is the lack of a thorough index. While it would be quite a task to supply such an index, yet with the vast amount of good information, it cannot be of the fullest value to a busy man, without some means of convenient reference to the information desired. The book will be of use to mechanical men in the office of the machine shop, drafting room and manufacturing establishment.

Transactions of the American Institute of Mining engineers, Volume XXIX. February, 1899, to September, 1899, inclusive.

In addition to papers of general interest to mining engineers, this volume, No. 29, contains a number of papers relative to metallurgical and chemical investigations of timely importance, among which are: "Nickel Steel: A Synopsis of Experiment and Opinion," by D. H. Browne, giving an excellent summary of present knowledge of that material. "The Effect of Heat Treatment upon the Physical Properties and the Microstructure of Medium Carbon Steel," by R. G. Morse, is an important addition to the literature of microscopic study of steel, and is illustrated by a series of excellent photo-micrographs. "Important Results Obtained in the Past Fifteen Years With the Stiff and Heavy Rail Sections," by P. H. Dudley, gives the experience of the New York Central & Hudson River Railroad in working up to its present standard of steel rails, and the "Investigation of Magnetic Iron Ores," by F. J. Pope, gives results of a research into the composition of the hitherto undeveloped titanic iron ores.

Differential and Integral Calculus, with Applications for Colleges, Universities and Technical Schools. By E. W. Nichols, Professor of Mathematics in the Virginia Military Institute. Published by D. C. Heath & Co., Boston, Mass., 1900.

This book is an elementary treatise and contains 400 pages, which is about 100 pages more than the type of book which it seeks to displace. Every page gives evidence that it has been a slow evolution from the class room and not a hasty patchwork. It is a creditable piece of work by a painstaking teacher who has been accustomed to give time and emphasis to such conceptions of the differential and integral calculus—especially the former—as can be easily grasped by the beginner. One short chapter is given to the Method of Limits. With this exception the Method of Rates is used throughout the portion of the book devoted to the differential calculus. The latter is defined as the "Science of Rates." However helpful the ideas of time and motion may be in introducing a student to the calculus, this statement should be guarded. The definition is special and incomplete. The historical notes are valuable and worthy the space given to them, but the early promise of many concrete problems from nature and the arts is unfulfilled after the first few chapters. When the subject of maxima and minima is reached the problems have become the stock ones hoary with age. Technical schools at least are still left to seek out from many sources a collection of exercises embodying the most recent engineering experience. In the integral calculus reduction formulas are derived and then employed in the usual way. Yet experience shows that many special problems should be worked by the student without using these general formulas for substitution, otherwise he will rarely gain any real insight into some of the most important expedients in integration. In establishing the process known as integration between limits, the author has used a method decidedly open to criticism, and one which cannot but confuse the student. Most of the book is to be commended.

Field Manual for Engineers. By Philetus H. Philbrick, C. E., M. S., Chief Engineer, Kansas City, Watkins & Gulf Railway. First edition, 16mo, 401 pages, 152 figures. Morocco, price $300. Published by John Wiley & Sons, New York, 1901.

It is the author's aim to present the text in a logical manner and to classify the problems for ease of reference; to express formulas with a view of simplifying numerical calculations and to extend the scope and usefulness of the tables; to present a more elaborate treatment of the problems pertaining to railway field engineering, than has hitherto appeared in such books. In the main, these aims have been accomplished, although there may, however, arise the question of proper balance between the degree of elaboration of the text and the scope of the tables at the conclusion of the book, depending upon the point of view of the critic; that is, whether the book be considered as designed primarily for the technical student or for the practicing engineer. The book contains not a few evidences that both requirements have been considered by the author, who has had a ripe experience both as engineer and teacher. For example, in pointing out the fact that logarithmic calculations are rarely used by the engineer in the field, he very consistently introduces a chapter on approximate and abbreviated computations in which are presented methods for avoiding the large waste of time in such work, which is common alike to the technical student and practicing engineer. However, the author's position in this particular would be much stronger had he included a table of squares and reciprocals in the list of tables. Doubtless this omission will be supplied in a later edition. Among the innovations in the book is the abandonment of the time-honored definition for "degree-of-curve," based on the chord, which had its origin in the necessity for straight-line measurement in laying out the curve in the field. The author assumes the ideal condition of a measurement of 100 ft. on the actual arc, by which the calculation of curve elements from his table of one-minute curve functions is made exact instead of approximate; and he also shows that sub-chord corrections are less by his method than by the original "single-chord definition." Those who are opposed to extreme refinements in field work will be likely to criticise this departure, and it seems certain that the advantages to be gained are not sufficient to justify its general adoption. The typography of the book is good, although the omission of boldface headings will prove an inconvenience. This manual ranks among the best which have appeared.

Ball-Bearing Jacks.—Mr. A. O. Norton, of 167 Oliver St., Boston, Mass., manufacturer of all kinds of heavy lifting jacks from 8 to 70 tons capacity, has sent a neat calendar for the year and a 1901 catalogue of ball-bearing jacks. The booklet illustrates the Norton double-speed ball-bearing, ball and cone-bearing, traversing and "sure drop" jacks; also cone-bearing car inspector's or journal jacks, and gives tables of sizes, weights and list of prices. The catalogue states that this company is in a position to turn out special jacks on short order and will send full information and quote prices on anything in the line of jacks.

Bearing Metals.—A new catalogue just issued by the Ajax Metal Company is entitled "Ajax Products" and is in every particular creditable. The book gives an extended discussion of the relative merits of their white metals, phosphor bronzes and the newly developed product, the "Ajax Plastic Bronze," as manufactured by them for railroad service. This metal is an alloy of copper, tin and lead, with a relatively large amount of lead, and has the very important attribute of plasticity, which gives it the best of wearing qualities. The latter part of the pamphlet is taken up with short descriptions of each of their copper and white metal products and a few finished products, including jewelers' specialties, which is a new department just established, also a reprint of a paper on the microstructure of bearing metals, by Mr. Gulliam H. Clamer, read before the Mining and Metallurgical Section of Franklin Institute, at the May, 1898, meeting, is given in full. The special engravings introduced throughout the catalogue are in the form of notable locomotives and a steamship which are equipped with Ajax bearings, four full-page engravings of the main and private offices of the company, their exhibit at the National Export Exposition at Philadelphia, the machine shop and chemical laboratory. These convey the impression of an extensive and very successful establishment.

An attractive and tastefully executed pamphlet, in fact, the best we have received this year, is that of the B. F. Sturtevant Company, Boston, Mass., devoted to a clear description of the Sturtevant system of combined heating and ventilating as it was applied to the Chicago & Northwestern round house, at Clinton, Ia. It is illustrated by seven clear and comprehensive illustrations of the round house and the blower system, and is specially noteworthy because this is the largest locomotive round house in the world.

The value of graphite as a lubricant, its nature, peculiarities and methods of application are fully considered, both scientifically and practically, in a little pamphlet issued by the Joseph Dixon Crucible Company. This is the seventh edition of the book, which has considerable new matter added to it. A copy of the pamphlet will be sent upon application to the advertising department of the Joseph Dixon Crucible Company, Jersey City, N. J.

Record of Recent Construction No. 21.—The Baldwin Locomotive Works have issued another of their attractive pamphlets illustrating recent locomotives built for home and foreign roads with tables of dimensions in French and English. It includes the recent 10-wheel and consolidation engines for the Rock Island and the Grand Trunk and simple consolidation engines for the West Virginia Central & Pittsburg, together with a number of foreign engines.

The proceedings of the tenth annual convention of the Association of Railway Superintendents of Bridges and Buildings, held in St. Louis, Mo., October 16, 17 and 18, 1900, have just been issued in the usual pamphlet form. This volume of over 300 pages gives a very concise history of the society, and the reports of the various committees and discussions in full, a number of individual papers by members of the society. Of these Mr. Walter G. Berg's paper on "The Education of Railroad Men for Subordinate Positions of Responsibility" is of particular interest, and of the reports, that of concrete masonry by W. S. Rogers is very valuable. It is the best paper on concrete we have seen. The proceedings of the association can be procured from the Secretary, Mr. S. F. Patterson, Concord, N. H.

Suspension Furnaces.—The Continental Iron Works, Brooklyn, N. Y., has issued an attractive cloth-bound catalogue of their suspension furnaces which have proved indispensable in marine boilers. Besides illustrating these corrugated suspension furnaces with both flanged and plain ends, types of flanging Morison furnaces, and removable types, the book gives a large table of working pressure, thickness of corrugated plates and rules for calculating this thickness. The Morison patent furnace front and door, for internal furnace boilers, is also illustrated and described and a partial list of steamships for which the Morison suspension furnace has been furnished.

Air Compressors.—A very complete catalogue of air compressors has just been issued by the Clayton Air Compressor Works, of Brooklyn, N. Y., manufacturers of air compressors of many types, for all pressures and purposes to which compressed air is applied. This book contains illustrated descriptions of air compressors, air receivers, vacuum pumps, carbonic-acid gas compressors and the Clayton air lift pumping system; also information regarding the transmission of compressed air and the capacity lost by air compressors in operation at various altitudes. Copies of this catalogue No. 11 will be sent to those who will address the offices of the Clayton Air Compressor Works, Havemeyer Building, 26 Cortlandt St., New York.

Steam Turbines is the title of a very attractive pamphlet issued by the Westinghouse Machine Company. It is a reprint of a paper by Mr. Francis Hodgkinson, on steam turbines, referring particularly to the Westinghouse-Parsons steam turbine. The paper was read at the November, 1900, meeting of the Engineers' Society of Western Pennsylvania and published in condensed form in the January, 1901, issue of the American Engineer and Railroad Journal. The author, who is justly considered the most eminent authority in this country on steam turbines, has in his paper given a general treatment of the subject and the pamphlet is worthy of a place in the files of all our readers.

The Stevens Institute Indicator of January, 1901, contains the best article on graphite, its origin, uses and processes of manufacture that we have seen. The author of the article is Mr. Malcolm McNaughton.

The Vitrified Wheel Company, Westfield, Mass., have put into their 1901 illustrated catalogue of emery and corundum wheels considerable information about the use of these wheels and suggestions as to the precautions to be taken in ordering. This company makes a specialty of turning out wheels to any shape desired, without extra charge. Besides cup wheels, emery cylinders and many of the special shapes of wheels for Brown & Sharpe grinding machines, the pamphlet describes a varied line of rubs, sticks, pencils, emery wheel dressers, and illustrates and describes a line of heavy grinding machines. One of the latest of these machines, and one which seems to be particularly well adapted for sawmill and all woodworking establishments, is the "Handy Grinder." To those interested in the use of emery wheels this catalogue will be sent on application to the Vitrified Wheel Company, Westfield, Mass.

"Best Form of Construction and Methods of Ventilating, Heating and General Equipment of Round Houses," is the title of a small pamphlet issued by the B. F. Sturtevant Company, Boston, Mass. The text of the pamphlet is condensed from the official proceedings of the May, 1900, meeting of the Central Railway Club and is illustrated by a full-page engraving of a section through a round house, showing water and air pipes, also the large hot-air duct necessary for the hot-blast system of heating. The pamphlet also gives a list of the round houses in which the Sturtevant system has been installed. This pamphlet contains the best of modern ideas on the subject of round houses.

The Bullock Electric Manufacturing Company has just issued bulletin No. 38, illustrating and describing electric locomotives for the use of manufacturers about their works, in handling materials. This bulletin may be had by addressing the Bullock Manufacturing Company, Cincinnati, O. This company report the following large list of sales of generators and motors for the week ending February 2: Joseph Joseph, Cincinnati, O., one 50-kw. engine type generator; Manning, Maxwell & Moore, New York, one 180-kw. engine type generator, one 35, one 50 and one 65-h.p. motors; Pittsburg Engineering Company, Pittsburg, Pa., one 30-kw. engine type generator; American Sugar Refining Company, New York, one 50-h.p. motor; John L. Thompson Est., Baltimore, Md., one 100-kw. engine type generator; The New Schuyler Apartments, one 50-kw. and one 25-kw. engine-type generators; Fore River Engine Company, Quincy, Mass, 14 motors of miscellaneous sizes, making about forty Bullock motors in all which this company has purchased; U. S. Finishing Company, Greenwich, Conn., one 75-h.p. motor; Mosler Safe Company, Hamilton, O., one 35-h.p. motor; Pacific Coast Borax Company, Bayonne, N. J., one 15-h.p. motor, making about twenty Bullock motors now in operation by this company; Wolf Process Lea. Company, Summerdale, Pa., one machine, 80-kw. engine type; Jacob Ruppert, New York, two machines, 60-kw. generators, engine type and switchboard, together with several small motors; National Enameling and Stamping Company, Baltimore, Md., one 65-h.p. motor; Christian College, Columbia, Mo., one 17½-kw. engine type generator; Bergtheil & Young, London, Eng., one 225-kw. type "H" generator and two 60-h.p. teaser equipments for operating newspaper press; Brown Hoisting and Conveying Company, Cleveland, O., one 25-h.p. motor; Columbia Chemical Company, Barberton, O., one 42½-kw. engine type generator.

EQUIPMENT AND MANUFACTURING NOTES.

Mr. J. C. Halladay, for many years western sales agent of the Pickering Spring Co., of Philadelphia, with headquarters at the Great Northern Building, hicago, has resigned that position to accept a position with the Chicago Pneumatic Tool Co., as Manager of a new department to be established by the Chicago Pneumatic Tool Company March 1st.

Chicago Rabbeted Grain Doors were specified on 1,000 box cars for the Illinois Central Railroad, which are now being built by the American Car and Foundry Company.

Mr. Sidney A. Stephens has been appointed agent for the Ashton pop safety valves and steam gauges throughout the Dominion of Canada, with headquarters at 22 St. John Street, Montreal, Can.

The Bullock Electric Manufacturing Company has recently opened an office at Buffalo, N. Y., 657 Ellicott Square. The offices will be under the management of Francis B. Smith, an electrical engineer of wide practical experience.

Mr. S. H. Riddell has been appointed representative of the Standard Steel Works, in St. Louis and the Southwestern Territory, vice Mr. C. A. Thompson, resigned. This company has opened an office at No. 712 Security Building, St. Louis, Mo., with Mr. Riddell in charge.

Appreciation of the merits of the Chicago Rabbeted Grain Door is indicated by the following orders of box cars recently let: C., C., C. & St. L. Ry., 2,200 cars; C., R. I, & P. Ry., 1,500 cars; Northern Pacific, 3,000 cars; A., T. & S. F. Ry., 2,000 cars, and Rio Grande Western Ry., 100 cars upon which it was specified. Most of these cars are now under construction.

The American Blower Company, of Detroit, Mich., manufacturers of hot blast heaters, fans, blowers, engines and dry kilns, expect to begin operation in the early spring upon extensive additions to their present plant. The plans contemplate a very large addition to the steel plate fan erecting shop. This will be of steel construction throughout. A new blacksmith shop, storage warehouse and power house will be erected. The power house will be equipped with new boilers, engines, dynamos, mechanical draft apparatus, etc., all of the latest design. The entire plant will be remodeled, rearranged and equipped throughout with new cranes, hoists and all modern improvements for handling work to the best advantage. A commodious and well-appointed wash room and lockers will be provided for the men. When the improvements are completed the plant will be one of the best equipped of its kind in the country.

Lubricating devices for high-speed stationary engines receive a noticeably large amount of attention, evidence of which is seen in the following quotation from "Engineering," describing a 1,250-h.p. Delauney-Belleville engine at the Paris Exposition: A thin film of oil under pressure is maintained over all the moving surfaces in contact, so that friction, and consequently wear, is reduced in a remarkable degree, and an unusual smoothness in running is obtained even at the highest speeds. An oscillating pump driven by a crank on the motor shaft forces oil continuously into a closed receiver furnished with a safety valve. A series of pipes proceed from this receiver to the various parts of the engine requiring lubrication; these parts are made either hollow or with closed channels that conduct the oil under pressure to the various points required. It afterward flows back into the reservoir in connection with the pump, which again forces it through the whole system, so that the circulation is constant and complete.

English manufacturers have once more been distanced by American competitors, the Pressed Steel Car Company being the enterprising concern in question. When the Rand Mines, Ltd., of Cape Colony, decided to purchase 334 steel coal cars, the Pressed Steel Car Company, of Pittsburg, would have received the entire order had it not been for adverse criticisms and insinuations of disloyalty in Great Britain. These criticisms were peculiarly disagreeable on account of the Boer War, but in spite of them, 167 pressed steel hopper gondola coal cars, of 60,000 lbs. capacity, were ordered from the Pittsburg concern. On the morning of January 28th, the first consignment of 30 cars were lying alongside the Steamer "Ellerie" in Jersey City. Thirty more of the cars were shipped to Jersey City January 29th, and by February 4th, the remaining 107 cars were ready to be stowed away for the long ocean trip to Cape Town. The 167 cars made in Pittsburg will reach their destination before those made by the English competitors. They have been constructed and shipped with such dispatch that more business from the other side of the Atlantic will doubtless follow.